Quality Control in the Soviet Food-Processing Industry

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FOREWORD

This study deals with a key facet of the Soviet government's longstanding efforts to improve the quality of the Soviet diet. While Western scholars have been noting improvements in the quality of the Soviet diet, they have only addressed the question of structure, i.e., the lower per capita consumption of grains and potato products and the higher per capita consumption of meat and dairy products. Alexander Kruglikov's study is unique in that it deals with the quality of the product per se, be it grain or meat, potatoes or milk. Before discussing the monograph at hand, it may be useful to examine the rapidly changing and present critical state of the food industry, in other words, the setting in which the struggle for quality assurance is taking place.

Over the course of the past two to three decades some very significant quantative and structural changes have occured which have impacted heavily on the industries transporting, processing and storing food: increases in population, and urbanization of the population, increases in agricultural output, and a shift in the composition of the Soviet diet.

In 1987 the Soviet population was some 70 million persons larger (roughly a third) than in 1960. Equally important is that this population had become more urban. The number of persons living in urban areas increased by some 80 million over the period, while the numbers living in rural areas fell by some 10 million, 4 million of whom had been farmers. To meet the needs of this expanded population, agricultural output in 1987 was roughly 70% greater than the average recorded for the period 1961-1965. Grain output was up 62%, vegetable output up 59%, meat output had doubled and the fish catch more than doubled.

The pressures on the sectors transporting, storing and processing food stemming from the above have been further compounded by a shift in consumption towards products requiring an ever higher volume and level of processing, such as meat, fish and dairy products. Between 1960 and 1986 per capita consumption of meat rose from 39.5 kg to 62.4; milk from 240 kg to 333; eggs from 118 ea to 268, and fish from 9.9 kg to 18.6. Over that same period, the per capita consumption of potatoes fell from 143 kg to 107 and that of grain products from 164 to 132. If in 1958 39.6% of all agricultural output underwent processing, in 1982 (the latest year for which I have figures) 60.2% did.

The capacity for processing, storing and transporting this ever larger percentage of an ever increasing volume of agricultural output, however, has chronically lagged behind needs. Investments in the food industry, as N.I. Ryzkhov, Chairman of the USSR Council of Ministers said in a speech in October of 1987, have been carried out on the basis of the "leftover principle." The result has been that the increase in the stock capital in agriculture has outstripped that in the food industry by a factor from 1.5 to 2. In many areas of the country, meat

processing capacity is only 45 to 50% of needs and shortages of vegetable canning capacity are also serious. Processing storage capacity, said Ryzkhov has become a serious brake on further increases in food production.

Not only is capacity inadequate, but it is for the most part (to use Ryzkhov's words) "neglected" and in some instances, in a "decayed state." A large part of the existing facilities were constructed prior to the Revolution and during the thirties, and the replacement of worn out and obsolescent capital has been at the rate of only 2% per annum. Overall, only 40 to 60% of the labor is mechanized. Of the 4 million persons working in the food-processing sector, 1.5 million work by hand. As the author, Alexander Kruglikov, informs us, the condition of the processing facilities and equipment is a prime determinant of product quality.

The geography of processing plants is also in a poor state. In his introduction, the author provides us with examples of the deplorable geography of the industry in prerevolutionary Russia. Ryzkhov, in his October '87 speech, felt compelled to comment on the fact that as a result of the irrational positioning of food-processing plants "hundreds of thousands of tons of output travel pointlessly around the country; the transportation system is senselessly overloaded; money is thrown to the winds, and large amounts of processed and unprocessed products perish."

As mentioned by the author, Soviet officials state that some 20-30% of all food harvested is lost in the transportation, processing storage cycle. It is now recognized that without enormous improvements in those areas, further improvements in the Soviet diet will not be possible. Thus, in October of '87, Ryzkhov announced a 77 billion ruble program of

investments in the food processing, storage and 1988-1990, and 56 billion during the period 1991-1995. Of that 77 billion, 37 is to be invested in food-processing equipment -- "more than the total amount invested for that purpose during the preceeding 40 years."

In the Introduction to his monograph, Kruglikov provides us with some historical background, touches upon some of the problems discussed above, provides us with some numbers on capacity, and gives some specifics on plans for expanding that capacity. In Chapter I he explains the process by which food standards are established in the USSR, describes the hierarchy of standards, and examines the roles and interactions of the many agencies and institutions involved in setting them.

In Chapter II Kruglikov explains how standards are ensured, using the cases of the meat, milk and nonalcoholic beverage industries. In the case of the meat industry, he provides us with a detailed look at the organizational structure of the enterprise department charged with quality control, and for all three industries, walks us through all or most of the production control cycle.

In Chapter III, methods of perserving and evaluating the quality of food products are examined. While one is quite pleasantly surprised to learn of the state of the art technologies and equipment used in some plants and laboratories, it must be kept in mind, as Alexander Kruglikov informs us, these advanced technologies are not in use everywhere. Finally, in Chapter IV, Kruglikov examines the problems and technologies of food transport.

The author is eminently qualified to carry out this study. He has a Master of Science from the Odessa Food Industry Institute where he specialized in the technology of the canned foods industry. He was

awarded a Candidate of Science (the equivalent of a Ph.D.) from the Kiev Institute of Trade and Commerce. His Candidate Thesis was entitled "The Quality of Foods." During the period 1947-1983, he worked in varying capacities in the food industry. From 1947-1964 he supervised all of the buying and selling operations for the Odessa Department of Sea Foods. From 1964-1968 he served as a food laboratory Manager for the Central Black Sea Foods Industry. From 1968 to 1973 he served as Chief Engineer for the Odessa Food Industry. He then shifted to academia and from 1973-1976, he taught courses on the quality controls of food at the Kiev Institute of Trade and Commerce. From 1976 until the time of his departure from the USSR in 1983 he taught classes on food-processing and quality control at the National Institute of Economics in Odessa. He has published over 40 books, pamphlets and articles.

It is because of this extensive experience, on both the empirical and theoretical levels with the problems of quality control, that the author is able to furnish us with such a wealth of information, a very large part of which is unavailable elsewhere.

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INTRODUCTION

AN OVERVIEW OF THE SOVIET FOOD-PROCESSING INDUSTRY

Quality control programs in the Soviet food-processing industry fuse together diverse scientific disciplines, including chemistry, microbiology, biochemistry and engineering. It is the integration of these broad disciplines that makes the task of quality control (QC) especially complex, and has shaped Soviet QC efforts into a multi-level program, subjecting each element of the food-processing chain to government controls. Before turning to the role of quality control in the Soviet food-processing industry, the author will present a brief overview of its development.

In prerevolutionary Russia in the late 1800s and early 1900s, there were more than 3,000 small scale enterprises in the Soviet food-processing industry, but most were modest establishments without automated processing equipment. While there were some large automated factories for wine, sugar and confectionaries, there were no plants specializing in the production of vitamins, margarine and food concentrates. Factories for tea and preserves were barely developed, and although flour mills, sugar refineries, vegetable oil mills and distilleries were in operation, most of the plants were limited to small scale production. Reliance on imported food-processing equipment further inhibited the development and productivity of the Russian food industry.

These deficiencies were exacerbated by the uneven distribution of food-processing establishments. Almost all sugar and alcohol production, for example, was concentrated in the Ukraine and the Central Chernozem region. Moscow, St. Petersburg and Kharkov had a virtual

monopoly (75%) on all confectionary manufacturers. Forty percent of the existing preserves plants were also located in Moscow and St. Petersburg. The remaining food-processing plants were scattered across the country.

From 1900 until 1938, many of the food-processing enterprises were renovated and retooled with mass-production machinery. The 1921 to 1941 period witnessed the construction of many new food-processing plants. Just as the Soviets began to experience greater productivity and install more sophisticated equipment into food-processing plants, World War II (1941-45) wreaked severe damage on the entire country. Most food-processing plants were destroyed or impaired and rendered inoperable. Production figures cited in 1945 were 52% less than those reported in 1940; meat and granulated sugar production dropped below the levels recorded in 1913.

After the War, the damaged factories were rebuilt, re-equipped and many new plants were erected. By 1973 the Soviet food-processing industry comprised more than 11,000 large-scale enterprises, with a work force of roughly three million. Statistics polled in July 1973 indicated that the Soviet food-processing industry consisted of 2,407 large factories and 12,634 small shops. These figures did not include the processing operations of hundreds of kolkhozes and sovkhozes and other industrial agricultural organizations. By the mid-seventies, automation could even be found in some of the most specialized food-processing tasks. One example is automatic screw presses which began to be used for obtaining vegetable oils from seeds; continuous extraction devices were used for making vegetable oils. Automation for more generalized purposes, by the mid-seventies, was already fairly widespread, such as the use of automated lines for bottling milk, beer and liquors, and

bottle washing. Overall, from 1945 to 1973 capital stock more than tripled and gross production virtually quintupled.

While the Soviet food-processing industry continued to flourish, other problems began to emerge. First, production levels, although improved, did not achieve the required levels. Aside from quantity, the problem of quality continued to plague the industry. Standards for quality control in the Soviet food-processing industry were first introduced in 1925, when the Committee on Standardization and the Council for Labor and Defense were established. In 1940, the All-Union Committee on Standards of the Council of People's Commissariat of the USSR was established on the highest governmental level in order to implement and enforce Soviet regulations in the food industry. Since 1951, these responsibilities have been entrusted to the Soviet State Committee for Standards (Gosstandart) of the Soviet Council of Ministers.

The mere existence of standards, however, does not ensure quality control, and the shortcomings of the Soviet food-processing industry are diverse and complicated. Some are region-specific, while others permeate the country. One of the most stubborn obstacles, confronted in all branches of the Soviet food-processing industry, is that indigenous food-processing technology falls far short of meeting modern requirements. Even when contemporary equipment such as assembly lines is available, food processors located in the remote regions of the country are difficult to supply. In addition, a substantial portion of the factory buildings and other installations have been in operation for decades without ever having undergone rennovation.

It is evident that the food-processing equipment in use today is generally obsolete and is unable to generate the needed productivity or quality. As a rule, food-processing plants are in operation for two

or three shifts and for all practical purposes, they are being fully utilized. For example, the capacity utilization rates in the production of granulated sugar, baker's yeast and salt exceeds 86%, and the production of confectionary products and the bottling of mineral water is 90%. Because the equipment is employed at maximum capacity, it is virtually impossible to increase output without sizable capital investments, including the construction of new food-processing facilities and retooling existing installations. Even if raw material and production losses are kept to a minimum, it will not result in a substantial increase of output.

On occasion, the Soviet government has responded to the problem of obsolete equipment by marginal increases in capital investment. For example, the Volga region's food industry has been allocated 360 million rubles of capital investments for the 12th Five-Year Plan (1986-1990), which is 2.5 times more than it received during the 11th Five-Year Plan (1980-85). Plans call for augmenting the annual Soviet food-processing capacity by more than 4,000 tons of sugar beets, 200 tons of oilseed, 26,000 tons of confectionary products, 4.2 million decaliters of non-alcoholic beverages and 30 million bottles of mineral water.

For the past two decades the Soviet strategy of quality control has been a multi-level approach so that the quality of foodstuffs is inspected at regularly specified intervals during processing as well as at different points in the control hierarchy of the Soviet food-processing industry. This will be explored later on in this monograph. It is evident from overt Soviet literature that the Soviets are trying to resolve their quality control problems in the food-processing industry. In addition to institutional enforcement of regulations, Gorbachev is implementing economic incentive programs to encourage quality workmanship.

In Soviet terms, quality is generally defined as the totality of a products' properties which determine its utilisation in service.[1] This definition was developed in the late sixties by a leading Soviet economist D. D. L'Vov. Ten years after L'Vov developed this concept of quality, the Soviets officially defined quality by a State standard (GOST 15467-79) as the "totality of the product's properties, determining its suitability to satisfy the requirements in accordance with its purpose." This definition of quality does not precisely apply to foodstuffs. In the food industry, quality is measured in terms of the basic nutritional value of a product. The Soviets use the term "use-value" of a food product which combines both its natural qualities plus any additional nutritional benefits such as vitamin additives, acquired through processing. The terms quality and use-value are frequently used interchangeably, but are not the same. Product quality describes the parameters or technical specifications of a given product. In contrast, the term use-value provides a more comprehensive appraisal, taking into account all of a finished products' attributes as well as consumer preference.

As is the case with food industries all over the world, there is a broad range of factors that can influence the quality of foodstuffs in the Soviet food-processing industry. Each phase of the food-processing cycle must be carefully evaluated -- from the selection of animals or agricultural products to the method of slaughter or harvesting, to the processing, storage and packaging of these products. Not surprisingly, the most basic variable affecting the quality of foodstuffs is the

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[1] L'Vov, D.S. in Akademiya nauk SSSR, Institut Ekonomiki, Ekonomicheskie problemy povysheniya kachestva promishlennoi produktsii (Moscow: Nauka, 1969), p. 7, 8.

selection of raw materials. High quality foodstuffs cannot be processed from low grade raw materials. Thus, the Soviet government has established many standards to regulate the selection of raw materials for use in food-processing. Other important factors which can determine the end quality of a food product, include the harvesting technology and the technological sophistication of the food-processing equipment. When product quality varies within a single batch, it can usually be traced back to the quality of the food-processing equipment. The skill of a given machine operator, divergences in a recipe, packaging materials, storage and transportation conditions can also affect the quality of foodstuffs.

All elements of the food-processing chain are subjected to government regulations. However, because of the frequent use of intermediate products, different quality controls may apply to a specific food product. Standards must take into consideration the intended purpose of products--nutritional, culinary or industrial. For example, the principal ingredients of tomato paste or juice are classified as solids, such as sugars or mineral additives. Fruit juices can be processed for different purposes, either to fulfill specific nutritional needs or satisfy culinary preferences such as its thirst-quenching quality. In the first case, quality depends to a great extent on the concentration of dried substances. Alternatively, when the juice is intended to quench thirst, the content of solids is limited to a maximum of 12%. In addition to qualitative norms, foodstuffs are also subject to quantitative regulations: size, number, volume, degree of refinement.

The objective of this monograph is to examine specific quality control efforts in the Soviet food-processing industry. The first chapter will describe the leading Soviet standards organizations, as well as

the overall Soviet approach to quality control of food products. Discussion of the Soviet principles of standardization, development and ratification of standards, as well as efforts to ensure enterprise compliance with standards are included.

While Chapter I will analyze the Soviet quality control system from a macro perspective, Chapter II will provide a micro view of specific quality control programs used at the enterprise level. Special emphasis is placed on the organization of quality control in the Soviet meat and dairy industries, although a case study of the organization of quality control in a non-alcoholic beverages plant is also presented.

Chapter III considers quality control in the Soviet food-processing industry from yet another perspective. Here, the Soviet methods for preserving and evaluating the quality of food products are described. The author examines Soviet preservation techniques, including physical, ionization, chemical and ultrasound. Soviet quality experts employ a variety of laboratory methods to test and evaluate the quality of foods. These methods are also included in the third chapter. The last part of this chapter will describe the Soviet systems for grading and ranking the quality of food products. The final chapter considers three additional variables of ensuring the quality of foodstuffs: packaging, storage and transportation.

CHAPTER I

STANDARDS AS A QUALITY CONTROL MECHANISM IN THE SOVIET FOOD-PROCESSING INDUSTRY

1.1 General

Standards for quality control in the Soviet food industry, as mentioned in the introduction, were first implemented in 1925, when the Committee on Standardization and the Council for Labor and Defense were established. Subsequently, in 1940, the All-Union Committee on Standards (Gosstandart) acquired the responsibility of assuring enterprise conformance with Soviet State standards. Today, Gosstandart is the highest government agency in charge of developing and instituting standards for all branches of industry. Recognizing that a comprehensive system of standards is the preferable way to ensure product quality, Soviet specialists have developed standards for raw and processed materials, semi-finished goods, assembly components and finished products. In fact, for every item that is manufactured in the Soviet Union, there exists a standard. Product quality is assured by the fact that standards provide minimum quality indexes, as well as consistent monitoring and testing methods.

The characteristics that make up product quality in the Soviet Union are described by continuous or discrete magnitudes which are called indexes of product quality. These indexes may be absolute, relative or specific and are expressed in quantitative measures. Indexes of product quality are determined by organoleptic methods (that is, by using the sense organs) and laboratory tests (physical, chemical, biological, microbiological). These will be explored in Chapter III of this monograph. A product quality index that describes one feature is called

a single index, whereas an index that describes two or more features is referred to as a composite index. A relative description of product quality based on a comparison between the product quality index and a corresponding set of base indexes is called the level of product quality. Both laboratory and organoleptic data are analyzed to determine this level.[1]

Periodically, the highest agencies of Soviet government have stressed the importance of the quality of foodstuffs. For example, in 1970, a joint decree entitled "Raising the Role of Standards in Improving the Quality of Output," between the Communist Party of the Soviet Union (CPSU) and the Soviet Council of Ministers was adopted. This decree spurred on changes in the administrative organization and management of product quality. It also established more precise guidelines for ensuring quality and preventing variations in the output of a single product type than had been used previously.

1.2 Soviet Standards Organizations[2]

The Soviet system of standards relies on an elaborate network of organizations, including ministries, scientific research institutes, plants and the like. Before turning to a technical discussion on the formulation of standards in the Soviet food industry, the author will

[1]See Chapter III for discussion of Soviet product quality grading system.

[2]Editor's Note: The information contained in this section reflects the organizational structure of the Soviet food industry as of 1983. It should be noted that since that time, Gorbachev's reforms and reorganization of the Soviet economy have resulted in some organizational changes of the Soviet food-processing industry. The most important change is that five ministries and one state committee of the food industry were dissolved and their responsibilities transferred to Gosagroprom (State Committee for the Agricultural Industry) which was created in 1985. The abolished agencies include: Ministry of Agriculture, Ministry of the Food Industry, Ministry of the Meat and Dairy Industry, Ministry of Fruits and Vegetables, Ministry of Rural Construction and the State Committee for the Supply of Production Equipment for Agriculture.

present an overview of the leading organizations involved in the development of standards. It should be noted that there are certain organizations that participate in the development of all standards for all branches of industry. In addition to these, each sector of industry maintains its own research organizations responsible for the establishment of standards for its product lines. In the broadest terms, ministries formulate standards for their respective industrial sectors. Thus, for example, the Ministry of the Meat Industry is in charge of developing and testing standards for meat and dairy products.

As mentioned previously, the committee in charge of standards in the Soviet Union is Gosstandart. Gosstandart was first created in 1951 as the State Committee for Standards, Measures and Measuring Instruments. In 1970 it was renamed the State Committee for Standards (Gosudarstvennyy komitet SSSR po standartam) or Gosstandart. Gosstandart exercises final authority over all questions pertaining to standardization. Before a standard is officially endorsed by Gosstandart, it must be reviewed and tested by the responsible enterprises, scientific research institutes and ministries.

In the food-processing field there are scientific research institutes (Nauchno-issledovatel'skiye institutі --NIIs) assigned to the task of improving the quality of foodstuffs. These institutes are usually operated by the industrial ministries. In the food industry, some of the leading institutes for the nutritient values of dairy, meat and meat by-products are the All-Union Scientific Research Institute of the Meat Industry (VNIIMP), Leningrad Technological Institute of the Refrigeration Industry (LTIKhP), Odessa Technological Institute of the Food and Refrigeration Industry (OTIKhP), the Moscow Technological Institute of the Meat and Dairy Industry (MTIMMP), and the All-Union Scientific

Research Institute of the Dairy Industry (VNIIMP) which has many affiliated laboratories in the Ukraine, Northern Caucasus, Altai, Belorussia, the Baltic region and the Transcaucasus. In addition to product specific institutes, there are certain core standards organizations which are involved in the formulation of standards for all branches of Soviet industry. These are presented in Figure 1.1 along with the standards agencies of the Soviet food-processing industry. Figure 1.1 illustrates the exchange of information and work flow for the development of standards. The figure is not intended to present hierarchical subordination.

It should be noted that standards are first developed as draft standards at the lowest levels -- institutes and enterprises. In their draft forms, standards are submitted to the supervising ministerial administrations responsible for reviewing and revising standards. The industrial ministries also have scientific research institutes that specialize in the testing of standards. Once standards are approved by the ministries, they are sent to Gosstandart for final approval and registration. The organizations included in Figure 1.1 are described in detail below.

1.2.1 All-Union Information Fond for Standards
<u>Vsesoyuznyy Informatzionnii fond standartov</u> -- VIFS

VIFS is the Soviet archives of all standards. Once standards receive their final approval from Gosstandart, they are registered with VIFS where they are kept on permanent record.

1.2.2 State Committee of Standards Publishing House
<u>Gosudarstvennyy komitet standartnogo izdatel'stva</u> -- Gosstandartgiz

After the standards are registered with VIFS, they are submitted to Gosstandartgiz for publishing and dissemination.

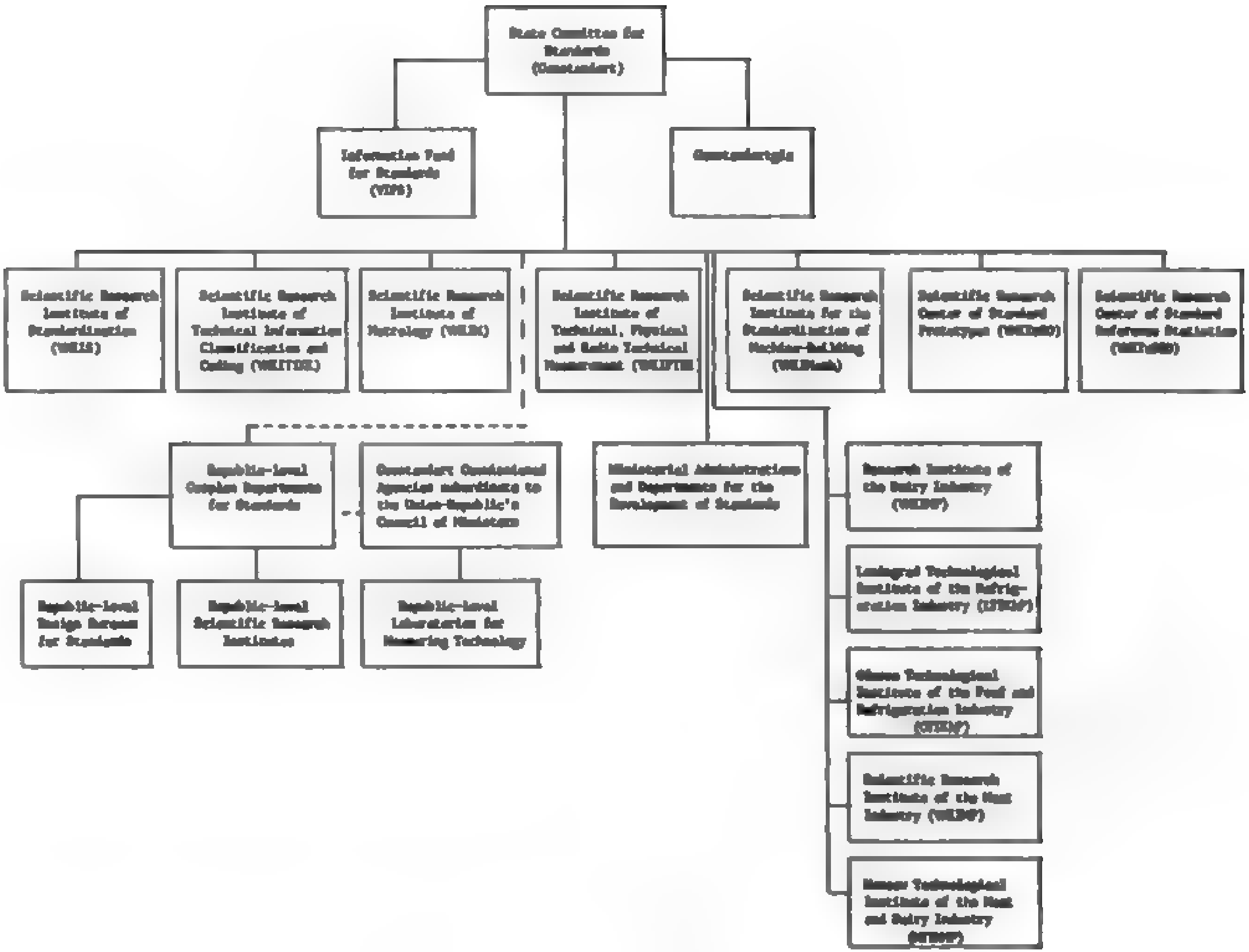

Figure 1.1

Information Exchange Between the Principal Standards Organizations

1.2.3 All-Union Scientific Research Institute of Standardization
Vsesoyuznyy nauchno-issledovatel'skiy institut standardizatsii -- VNIIS
Subordinate to the State Committee for Standards

Based in Moscow, this institute specializes in the development of unified criteria and systems for evaluating the operations of industrial enterprises. In cooperation with institutes of the computer and automation industries, VNIIS has also emphasized the importance of creating automated quality control systems.

1.2.4 All-Union Scientific Research Institute of Technical Information, Classification and Coding
Vsesoyuznyy nauchno-issledovatel'skiy institut tekhnicheskoy informatsii, klassifikatsii i kodirovaniya--VNIITIKK
Subordinate to the State Committee for Standards

Established in 1965, this institute pioneered Soviet efforts to create a unified system of product classification and coding. VNIITIKK sponsors several publications on Soviet and international achievements in the fields of standardization and product quality control.

1.2.5 All-Union Scientific Research Institute for Metrology
Vsesoyuznyy nauchno-issledovatel'skiy institut metrologi -- VNIIM
Subordinate to the State Committee for Standards

This institute ensures the unity of measurements in all industrial sectors, conducts tests of experimental models and inspects both conventional and newly-developed instruments. Headquartered in Moscow, branches of this institute are based in Leningrad, Sverdlovsk and Tbilisi.

1.2.6 All-Union Scientific Research Institute of Technical Physical and Radio Technical Measurement
Vsesoyuznyy nauchno-issledovatel'skiy institut fiziko-tekhnicheskikh radio izmerenii -- VNIIFTRI
Subordinate to the State Committee for Standards

Founded in 1955, this institute specializes in various types of measurement-related research. VNIIFTRI's R&D is organized into five laboratories: radio measurements, measurement of time and frequency, acoustic measurements, heat measurements and measurements of super-high pressures.

1.2.7 All-Union Scientific Research Institute for the Standardization of Machine-Building
Vsesoyuznyy nauchno-issledovatel'skiy institut normalizatsii mashinostroyenii -- VNIIMash
Subordinate to the State Committee for Standards

This institute was organized in 1960 to ensure the standardization of machine construction; that is, the interchangeability of parts and units for the same types of machines manufactured in different plants.

1.2.8 Scientific Research Center of Standard Prototypes
Nauchno-issledovatel'skiy tsentr standartnykh obraztsev -- VNITsSO
Subordinate to the State Committee for Standards

VNITsSO is responsible for ensuring that all industrial prototypes are standardized, approved by the pertinent ministries and Gosstandart and registered with VIFS before serial production of a new product line is launched.

1.2.9 Scientific Research Center for Standard and Reference Statistics
Nauchno-issledovatel'skiy tsentr standartnye i spravochnye dannye --VNITsSSD
Subordinate to the State Committee for Standards

This center keeps track of both Soviet and international data on standards, especially statistics. Access to such information by the scientific research institutes and enterprises is granted on a need to know basis.

1.2.10 Scientific Research Institutes of the Food Industry (VNIIMP, LTIKhP, OTIKhP, VNIIMP, MTIMMP)[1]

The scientific research institutes of the Soviet food-processing industry presented in Figure 1.1 are the leading agencies in charge of specialized research on the quality of foodstuffs in the USSR. Institutes of the meat and dairy industry study and test food preservation technology before it is implemented in plants. For example, the Soviets use a variety of pasteurization techniques as well as physical, chemical and biochemical methods for preserving dairy and meat products. These institutes (VNIIMP, VNIIMP and MTIMMP) also develop standards for the processing of meat and dairy products.

Institutes of the refrigeration industry (LTIKhP and OTIKhP) examine storage conditions for foodstuffs such as temperature and life. Standards on storage and transportation, especially for perishables are also developed and tested by LTIKhP and OTIKhP.

1.2.11 Republic-Level Standards Organizations

In addition to the industrial standards which apply to the entire country, each of the fifteen republics maintain their own network of standards organizations. The R&D cycle for standards at the republic-level works in much the same way as standards that apply to all branches of Soviet industry. The only difference is that standards formulated at the republic level apply only to those products which are manufactured and sold in the individual republics. These standards are region-specific; for example, specialized standards are prepared for the processing of some ethnic foods.

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[1]It should be noted that both the Research Institute of the Dairy Industry and the Scientific Research Institute of the Meat Industry have the same acronym.

Draft standards at the republic level are prepared by various republic level standardization services. These services review all proposals for draft standards developed in the republic. Changes are usually minor, such as the simplification of testing procedures. Determinations made by the republic standards services are submitted to the Soviet State Planning Committee (Gosplan) for approval before they are submitted to Gosstandart.

1.3 Principles of Soviet Standardization

The Soviet concept of standardization is essentially the same as the international concept which was developed by the International Organization of Standardization (ISO).[1] The aim of Soviet standards is "to control and regulate the activity in a given area and ensure that all responsible organizations and individuals comply with the pertinent industrial safety codes." In the Soviet Union, standards appear as written norms. They are approved by Gosstandart and have the power of law.

1.3.1 Classification of Soviet Standards

From the raising of crops to their harvesting, production and distribution, the Soviet food-processing cycle is an intricate, multi-stage operation. Each element of this cycle is subjected to government quality controls. To cope with this complexity, a hierarchical system of organizations was created to manage industrial standards at the enterprise industrial, republic and national levels and was described in section 1.2. Accordingly, standards are subdivided on the basis of their importance into national (GOST,) republic (RST), industrial sector

[1] The Soviet Union is a member of the ISO and has based many of its standardization practices on those of the ISO.

(OST) and enterprise (STP) standards. National standards are approved by Gosstandart, and are binding for all enterprises and institutes throughout the country. In the food industry, GOSTs have been established for such products as bread and bakery products (with the exception of ethnic products), flour, grains, rice legumes, salt, meat (beef, lamb, and pork), meat by-products, canned vegetable goods, powdered cocoa, natural tea and coffee, animal and vegetable fats, margarine, canned dairy products, powdered eggs, fish, caviar, canned fish, alcohol and vodka.

Republic and industrial sector standards are approved by the union-republic councils of ministers and responsible ministries. Republic standards are mandatory for all republic-level and local-level organizations in the pertinent union-republic regardless of subordination. OSTs apply to the products of a specific industrial branch or sector. An example of an OST in the food industry might contain regulations pertaining to harvesting equipment. Enterprise standards are developed by individual enterprises in strict conformance with the prevailing state, industrial sector and republic standards. In general, STPs serve as an organizational-methodological basis for controlling product quality within enterprises. The finished output of the plant, however is not subject to enterprise standards. Thus, for example, if different enterprises manufactured the same components for the harvesting equipment, their products must be evaluated in terms of an objective regulation. Therefore, the actual output of these enteprises would be subjected to OST controls. All standards are reviewed at specified times, usually every five years.

Thus, different organizations create standards while others are responsible for implementing and enforcing them. For example, a single

factory oversees compliance with standards that affect the manufacturing processes for its product-line, while a research institute may be responsible for developing standards for packaging. Occasionally, this organizational framework for developing standards has generated bureaucratic infighting. Although the author is unable to recall any specific examples, it should be noted that conflicts over the application of standards can cause long delays in production.

Only those products which meet technical specifications stipulated by GOSTs are ready for marketing. Products failing to meet these technical specifications are considered substandard. It is illegal for an enterprise to distribute substandard goods. Enterprise directors who wittingly distribute substandard products may be held liable and fined.

1.3.2 Product Classification

The effectiveness of standards in the Soviet food-processing industry depends on an organized system of product classification or nomenclature. Product quality is evaluated in terms of specific indicators established by standards. In accordance with this system, the product category, its classification by type and brand, grade, quality and required packaging, transportation and storage arrangements are clearly defined.

All product classes used in the Soviet food-processing industry are organized in terms of the nutritient value for the product which make up the class or category. In all, Soviet food products are divided into 98 classes, each class into subclasses, each subclass into 10 groups, each group into 10 subgroups, and each subgroup into 10 types. This information is printed on the product label. The classification system utilizes a product numbering system. The first two digits indicate the

product class. Following the product class are subclass, group, subgroup; each is denoted by a single digit. Thus, for example, whole coffee beans are designated 915811 and ground 915812, where 91 = class, 5 = subclass, 8 = group, 1 = subgroup, 1 = type.

The technologies used in the food-processing are also specified. There are ten such categories. For example, pasteurisation, sterilization, microwave and others. The processing technology used for any given product is identified by a number which is part of the product's serial number and appears on the label.

1.4 Coordination and Development of Industrial Standards

Effective coordination of the work of all Soviet standards organizations depends on coordinated planning. In the Soviet Union, Five-Year Plans and annual or one-year operational work plans are developed for all industrial sectors. The planning of standards is carried out by Gosstandart, pertinent ministries, union-republics and individual enterprises. Gosplan (State Committee for Economic Planning) usually calls for the improvement of the quality of output, a rise in labor productivity, development of a unified, accurate system of measurement, coordination of standardization with CMEA countries and continual international cooperation *vis a vis* the formulation of standards.

In general, standards in most sectors of industry require approximately two years to develop, test and implement. With an eye towards accelerating the development of standards, Gosstandart has established the basic phases through which each standard should pass:

- Innovation
- Draft standard

- Submission of draft standard to responsible ministry (to receive authorization for testing)
- Testing
- Processing and drafting final (second) edition of standard
- Preparation, coordination and submission of standard to supervising ministry and Gosstandart
- Registration numbers assigned to standard and a permanent file is placed in All-Union Fond for Standards
- Publication and dissemination of standard

In the course of the development of a draft standard, all related materials for the product under investigation are studied. Any existing standards, patents, remarks by the author or other technical documentation are consulted. Draft standards are circulated to the major plants, manufacturers and consumers, as well as to other interested organizations such as union-republic commercial organizations. For standards in the food-processing industry, the Ministry of Public Health often plays a major role. Comments on the draft standard are to be returned to the sponsoring organization in no more than one month. Criticisms of the draft standard are expected to be scientifically documented.

Quite frequently, a draft standard evokes conflict between the sponsoring organization and the reviewing enterprise. Because standards are formulated by industrial scientific research institutes for ministries, it is not uncommon for conflicts of interest to arise. In these cases, the industrial ministries and the managers of the scientific research institutes jointly examine the criticisms to resolve the discrepancy. If the discrepancy cannot be resolved, or if the complaints against the standards are considered valid, the standard will be returned to the sponsoring organization for redrafting. In extreme

cases, a draft standard may be submitted to the appropriate state jurisdictional body. For example, if the standard pertained to packaging or storage conditions, it would be submitted to the Main Epidemiological Administration of the Ministry of Public Health of the USSR.

1.5 Compliance with State Standards

Government supervision over the introduction of, and compliance with, state standards is carried out under the auspices of Gosstandart's standardization and technical measurement laboratories, which can be found in virtually every oblast. In addition, Gosstandart distributes guidelines to many scientific research institutes enabling them to assist in the monitoring of conformance with standards. Inspectors from Gosstandart may make unannounced spot inspections of plants, and question plant officials and technicians about the operations of the plant, including its utilization of resources, equipment maintenance and workmanship. Gosstandart also maintains the right to prohibit shipments of products which do not comply with standards. A plant director can be held responsible for producing substandard goods and prosecuted.

1.6 Certification of Product Quality

Government certificates of quality were first introduced in 1967. These are awarded to products which comply with or exceed the highest quality indices attained in Soviet or foreign industry. The labels of high quality products are embossed with a seal (see Figure 1.2) which is shaped like a pentagon, in which, over a stylized letter "k," the "USSR" is inscribed. The letter "k" is placed horizontally, creating the image of a scale. Soviet manufacturers have an incentive to manufacture products with such labels even though the retail prices for products

carrying the quality mark are not higher. This is due to the fact that products carrying such labels are in greater demand and thus, generate higher revenues. It should also be noted that the quality mark is issued

Figure 1.2

Soviet Sign of Quality

to the output of a particular plant or individual products and not to the entire product class. If a product is to be awarded the quality mark, it is usually issued within two years after the product has entered the market.[1]

1.7 Soviet Product Quality Control Systems and the Role of Standards

Product quality control is a complex operation carried out in all sectors of Soviet industry to guarantee and maintain the required

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[1] A variety of raw smoked sausages, choice bacon, canned meat, stewed beef, pork goulash, liver pate, and other foodstuffs have been awarded the Soviet quality seal. Candies carrying the Soviet government sign of quality include: "Basni Krylov" (Leningrad Confectionery Factory), "White Acacia" (Odessa Confectionery Factory), "Vilnius," (Estonian Confectionery Factory), "Sputnik/Satellite," "Charodeika/Enchantress" (the Babaeva factory in Moscow). Wines: "Mukuzani," "Semeravi," and "Khvangkara." Cognacs: "Tbilisi," "Yenisei." Fruit beverages: "Saiany," (Novorossiisk Beverage Factory).

quality level of output. In the Soviet Union, there are three basic systems for controlling product quality. The nation-wide system for product control is known as the Unified System for Product Quality Control _Yedinnaya sistema upravleniya kachestvom produktsii_ (YeSUKP). The quality control system for industrial sectors is called _Otraslevive sistemi upravleniya kachestvom produktsii_ (OSUKP), and at the enterprise level, there is the _Sistema upravleniya kachestvom produksii_ (SUKP).[1]

Each of the above-mentioned quality control programs is tailored to the specific needs of either the nation, industry or enterprise. The program for nation-wide quality control tends to be the most generalized. Industrial and enterprise level programs are more specific about managing quality control.

Ensuring product quality in the meat and dairy industries, for example, must take into consideration the quality of raw material, technical tooling of production, the skill of the labor, the state of the technical discipline and adherence to sanitary-hygiene requirements for production. Thus, the effectiveness of product quality control is ensured by a comprehensive approach and careful coordination of these individual elements entering into the final product.

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[1] _Editor's Note_: It should be noted that since the author's departure, there has been some modification in the organization of Soviet quality control programs. In January 1987, the State Committee for Standards (Gosstandart) introduced teams of state quality inspectors at 1500 selected Soviet plants, thereby officially initiating the State Quality Inspection Program (Gospriyemka). As of 1987, this system embraced 1500 of the USSR's 48,000 enterprises, accounting for 20% of the total industrial output. On August 13, 1987, Gospriemka was extended to 732 new enterprises, many of which are engaged in food-processing. The specifics of how Gospriemka will affect the Soviet food-processing industry are still unavailable, except that ultimately Soviet officials hope to change all enterprises over to the new system of quality control. Reports, however, for the other sectors of industry have shown that enterprises are being singled out for poor performance and their products rejected for failing to conform with their respective GOSTs.

Each of the three quality control systems (YeSUKP, OSUKP, SUKP) provides concrete measures and methods for establishing and maintaining the required level of product quality. Listed below are some of the key objectives of all Soviet quality control programs (YeSUKP, OSUKP and SUKP):

- Improve methods for raising product quality
- Develop new product lines
- Improve metrological specifications
- Improve material provisions
- Improve training of personnel
- Assure consistency in the planned level of product quality in all phases of the production-distribution cycle
- Encourage and develop incentives for improving product quality
- Supervise the introduction of, and adherence to, standards

Soviet quality control programs also have provisions for morale and material labor incentives of enterprise workers. The objective of morale and material labor incentives of labor quality is, not surprisingly, to mobilize enterprise workers to fulfill and overfulfill tasks pertaining to quality. For example, an effort is being made to economize on the amount of material used in production. As an incentive, workers who achieve such reductions are paid bonuses. The size of the bonus depends on the amount of material saved.

1.8 Summary

Although the Soviets have made some positive steps to improve the organization of quality control programs in the food processing industry, there continue to be certain standing goals: creation

of a unified system of quality indicators and methods for their testing and evaluation; development of new, as well as improvement of, existing units of measurement; improvement of terminology and nomenclature in all branches of science and technology; greater participation in the work of the International Standards Organization, and expansion of international cooperation on standards with CMEA countries.

CHAPTER II

QUALITY CONTROL ASSURANCE PROGRAMS IN THE SOVIET MEAT, DAIRY AND NONALCOHOLIC BEVERAGES INDUSTRIES

2.1 General

For the past twenty years, Soviet food quality assurance programs have utilized a multi-level approach to quality control. State regulations require that all foodstuffs undergo a systematic quality inspection at specified intervals in the food-processing cycle. Thus, from the time raw materials are gathered in the field until the time they are available for consumer purchase in the store, raw materials are subjected to government controls. The basic critical control points used in the Soviet food-processing industry are similar to Western quality controls:

- Raw material
- Each phase in the processing cycle
- Storage
- Shipping

At each of these stages, inspections are carried out to ensure that the appropriate standards have been met. Different food products are subject to different types of inspection. For example, quality control over meat and dairy products is conducted at different critical control points, such as when the animals are brought to the markets for sale and slaughtering. Meat and dairy products are further inspected by the Department for Production-Veterinary Control (OPVK) or Otdel proizvodstvenno-veterinanogo kontrolya when received by the meat-processing plant.

In this chapter, the author examines the quality assurance programs used in the Soviet meat and dairy industry. The first section describes

the organization of quality control in meat and dairy enterprises. The remaining sections of the chapter will examine how quality control programs are organized in other branches of the food-processing industry, using as a case study, a non-alcoholic beverages plant.

2.2 Organization of Quality Control in Meat and Dairy Enterprises

All meat-processing plants have departments for Production-Veterinary Control (OPVK) which are responsible for controlling the quality of meat and dairy products. The size of the OPVK varies depending upon the size of the plant and production assortment. The organizational structure for the OPVK of a large meat-processing plant is presented in Figure 2.1.[1]

An OPVK for a large meat and dairy plant is comprised of a senior veterinarian, a staff of veterinarians, and three department sections for sanitation control, monitoring the temperatures of animals and infection control. The senior veterinarian is also the director of the OPVK, and as such is in contact with the Main Veterinary Administration of the republic Ministry for the Meat and Dairy industry to keep apprised of current regulations on meat and dairy products. The senior veterinarian also has contact with the republic-wide veterinarian control service. Communication between the plant director or chief veterinarian and the republic veterinarian control service is kept to a minimum. It usually pertains to broad policy questions on quality control for meat and dairy products concerning regional issues such as an outbreak of an epidemic which can affect the livestock of an entire region. As mentioned, the size of OPVKs can vary. In small plants, for

[1]Also presented in Figure 2.1 is the organization of the Technical Control Department (OTK) which is discussed in section 2.2.

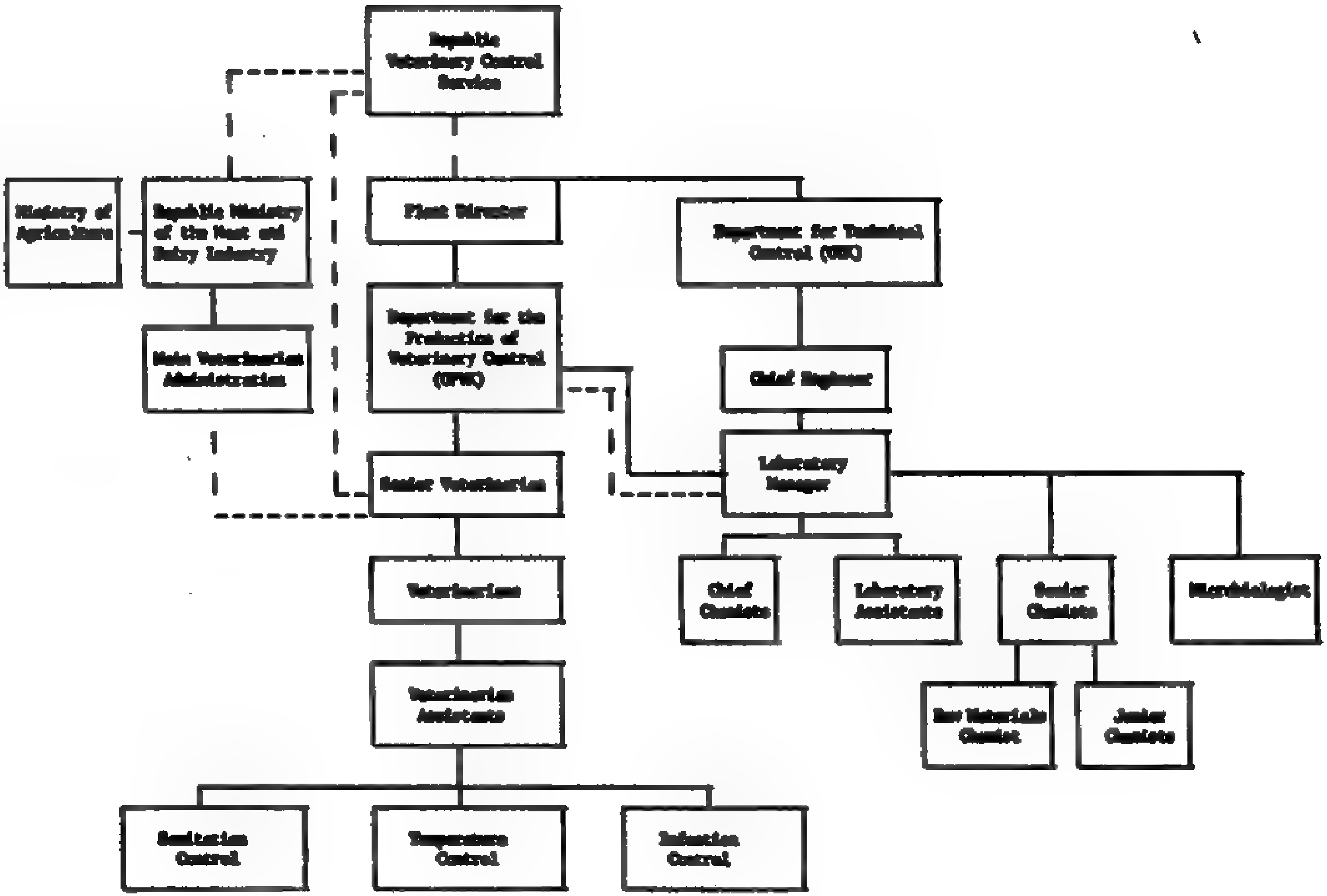

Figure 2.1

Organizational Structure of the OPVK and OTK

example, there is usually only one veterinarian responsible for carrying out all of the OPVK's duties.

The principal responsibility of the OPVK is to control and ensure a uniform quality of raw materials and their compliance with State standards. Other responsibilities of the OPVK are as follows:

- Enforcement of norms, regulations and rulings established by Soviet Veterinarian Control Service, the Soviet Ministry of Agriculture,[1] and the Main Veterinarian Administration
- Ensure proper veterinary-hygienic control of meat and meat by-products
- Monitor and evaluate raw materials
- Detection of substandard materials and products
- Certification of the quality of carcasses and confirmation of sanitary working conditions
- Inspection of livestock and slaughtering operations
- Investigation of substandard output and the development of corrective measures
- Inspection of storage conditions for raw materials, meat and meat by-products

2.2.1 Quality Inspection Cycle

Veterinary control begins with the inspection of cattle delivered for processing. A veterinarian conducts a head count and examines the animals' condition, fat content and weight to determine conformance with veterinary regulations. A by-the-head examination of the cattle is also performed by an OPVK veterinarian which includes taking the animals' temperatures and establishing a triage for unloading and distributing the animals. From the results of the examination, a conclusion about the state of health of the animals is made. Healthy cattle are sorted according to age group and means of processing. Accordingly, the cattle

[1]See footnote 1 on page 16 of Chapter I.

are directed to a pen, pre-slaughter treatment, or to quarantine. Those with questionable health are placed in quarantine. At this time the condition of the leather hide is also determined. All of these procedures are recorded on a registration card, which accompanies the lot as is it passes through each phase of the processing cycle.

On the day of slaughter, another veterinary examination is conducted and the animals' temperatures are again taken in the pre-slaughter treatment shop where the preparedness for slaughter is confirmed. In the cattle slaughter house and carcass cutting shop, there are many possible sources of contamination which can affect the quality of the hide. Thus, the role of the OPVK is especially important--to ensure sanitary conditions and quality control in production and special slaughter posts.

A common slaughtering process used in the Soviet food-processing industry is electrical-stunning in a box. The voltage and amperage, as well as the length of shock time are carefully controlled. The procedure for hanging the carcasses to bleed is also closely monitored. The sanitary stations at the stunning boxes are inspected and the hide and carcass are checked for cuts, gashes, holes and perforations. Special quality control guidelines have been established for singing pig skins and cleaning the carcasses. Even the temperature and purity of the water in the scalding tanks are controlled. An immediate examination of the carcass is carried out by the veterinarian on duty. The internal organs should be extracted as soon as the skin has been removed. The carcasses are then cut, trimmed and split from the breastbone and spine to make half-carcasses. Butchers are careful not to sever the spinal cord or crush the vertebrae. While the hides are being cleaned, samples are taken for trichinosis testing.

At this stage, the veterinarian determines the quality of the meat and assigns it to one of several nutrition categories. The suitability of meat for human consumption is certified with an inspector's seal. Next, the meat is graded, sorted and marked according to different grades of quality. For example, Category I beef is stamped with a round seal in purple ink, Category II is denoted by a square seal and poor quality beef is marked with a triangular seal.

The sanitary-hygiene conditions that prevail throughout all phases of the food-processing cycle are clearly defined. The condition of the meat and other by-products of sausage production are carefully checked. Thus, when the meat is stripped or ground, a special examination is conducted for hidden pathological changes in the deep layers of the muscle, and during pickling, the meat's aging is determined by temperature checks. The quality of the final sausage products is evaluated by both organoleptic (appearance, color, smell) and chemical tests at in-plant laboratories. As a rule, a low organoleptic evaluation may give cause for follow-up bacteriological investigations. If during the OPVK inspection, a product fails to comply with Soviet State standards in terms of salt, water, starch and nitrite content, it will be returned for reprocessing. Production may be stopped until the cause(s) of defective products are identified.

The rate and duration of freezing meat is important for maintaining its quality. The humidity, air circulation rate, as well as other storage conditions are also closely controlled. Before the meat is distributed, the OPVK evaluates the freshness by means of organoleptic indicators. Chemical analyses (sulphate tests) are also performed to determine the content of light fatty acids. Bacterioscopic investiga-

tions are carried out to determine the microbes, cocci and bacilli counts. Numerical values are assigned to the product for each inspection and a minimum score is required for distribution.[1] Before shipment, however, veterinary documents must be prepared, certifying the quality of the products. These documents accompany each shipment.

2.2.2 Technical Control Departments

In Soviet food-processing enterprises, different steps of the product quality control program are carried out by the Technical Control Departments Otdely tekhnicheskogo kontrolya (OTK). The OTK, illustrated in Figure 2.1, is responsible for many of the technical aspects of the quality control of foodstuffs. The OTK is guided by prevailing State standards, special instructions and/or regulations on chemical processing, as well as microbiological control and sanitation.

In Figure 2.1, the organizational structure of a typical OTK for a food-processing plant is presented. The difference between the OTK and the OPVK, described previously, is that the latter supervises the selection and slaughtering of animals while the former is in charge of controlling the quality of the technical aspects of food processing. In addition, the OTK ensures the quality of packaging materials, and the calibration of measuring equipment. All OTK personnel report to the OTK laboratory manager, who reports to the plant's chief engineer. The chief engineer is directly subordinate to the plant director. In addition to the OTK laboratory manager, there is an engineering staff consisting of a senior chemist, microbiologist, raw materials chemist and

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[1] See Chapter III for an in-depth examination of laboratory inspections of foodstuffs as well as Soviet quality rating systems.

junior chemists. In technologically-sophisticated enterprises with mass production capacity, there are also laboratory assistants. The senior chemist is responsible along with the OPVK veterinarian for ensuring the quality of raw materials. The raw materials chemist verifies that the selection of raw materials complies with current State standards. The task of the microbiologist is to ensure that there is no microbiological contamination of raw materials and liquids. The microbiologist also develops antiseptic measures to prevent microbiological contamination.

The number of junior chemists on staff depends on the size of the plant. Usually there is a junior chemist in charge of chemical and technical control in each laboratory. Junior chemists perform analyses and evaluations of semi-finished materials, finished merchandise and industrial waste, as well as monitor technological processes and the sanitation conditions of the plant and equipment. These analyses and tests are generally performed upon the specific request of a senior staff member. The laboratory manager, along with the laboratory assistants, performs additional inspections on incoming raw materials, auxiliary materials and semi-finished products.

The results of all tests and evaluations are documented in laboratory journals which are regularly submitted to the chief engineer, who then reports to the plant director. Data collected from intermittent quality inspections helps to develop and refine the food-processing system so as to avoid uneven quality or excessive losses. The findings of the evaluations are recorded in eight journals which are described below:

- **Journal for Notes:** contains information on the weight and value of all incoming raw materials, auxiliary materials, and semi-finished products. It is filled out by the central laboratory chemist in the depot or warehouse.

- **Journal of Analysis:** contains the results of spot tests on incoming raw materials. This journal is filled out by the central laboratory chemist, but must be signed by the laboratory supervisor. If the raw material is high quality, positive notification is sent to the supply room and warehouse. If the raw materials fail to comply with State standards, negative results are reported to the laboratory manager or chief engineer who then determines what action should be taken.

- **Journal of Semi-finished Products and Final Output:** documents the research results of routine and unscheduled analyses performed in the OTK; for example, selective tests on finished merchandise, quality inspections, and intermediary analyses. These journals are prepared by the central laboratory chemist.

- **Technological Control Journal:** is maintained by the junior chemist and contains data on the technological aspects of processing and is used to check them against GOSTs.

- **Quality Control Journal:** records the results of organoleptic evaluations performed on incoming raw material, semi-finished products and is filled out by the junior chemist. The journal serves as a record of organoleptic indicators. Should substandard material be found, a statement is drafted and sent to the production department for determination.

The OTK prepares for Gosstandart, or the responsible ministry, its plan for product quality control.[1] The plan stipulates the size of the control batch, the results of the test and frequency of testing. The work plans are used throughout the Soviet food-processing industry for all foodstuffs, and indicate the type of raw materials as well as the technological capability of the plant. Controls begin with the inspection of each lot of raw material received by the enterprise. In a dairy plant, for example, the quality of milk and other dairy products must be confirmed. Towards this end, systematic sampling is carried out on a daily basis. Samples are taken from each container whether small

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[1]A Glavk (glavnoye upravleniye or main administration) is a ministerial supervisory department. In the Soviet Union, every ministry is comprised of Glavki which are responsible for monitoring the manufacture of specific products or keeping track of a particular scientific or technological discipline.

milk cans or tanks. Quality control of raw material is conducted with the aim of evaluating the physical (temperature, purity, content of water and dry substances), chemical (acidity, butter fat content, pasteurization effectiveness), organoleptic (taste, smell, color, consistency), and microbiological (bacteriological count) properties. The results of these evaluations are documented in the previously-described laboratory journals. These analyses determine whether or not the raw materials should be used in production. The tests also help to determine the shelf life of the raw materials, as well as the appropriate sequence for processing individual lots.

Containers (bottles, boxes, milk cans) arriving at the enterprise are selectively inspected for their compliance with GOSTs and technical specifications (height, neck diameter, sealant factor). Such ingredients as granulated sugar, salt, raisins and vanillin, as well as labels are also inspected according to their respective GOSTs with the aid of organoleptic and physical-chemical analyses. Supplies which are of poor quality or fail to comply with regulations are prohibited from use in production. In such cases, the OTK issues a complaint to the supplier.

Operational control is the inspection of products or industrial processes during, or subsequent to, the completion of a particular operation. Operational control is conducted on a daily basis no less than two times per shift by the brigade foreman with the assistance of the grading inspector or an OTK representative. This type of control can be continuous or selective. Operational control has been found to be the most effective form of production control for guaranteeing compliance with production requirements.

The results of the inspection control are recorded on an acceptance chart no less than two times per month. The goal of the inspection

control is to determine enterprise conformance with regulations on storage and packaging. The findings of spot or unannounced inspections are analyzed on "quality days" when the overall quality level of shops, brigades and individual workers is reviewed. Measures for improving the quality of manufactured products and eliminating indicated breaches are developed on the basis of these findings.

Packaged products are also carefully inspected prior to distribution. For instance, a sample for analysis in the production of potable milk is selected before pasteurization, during pasteurization and after it has been placed in storage. More precisely, during pasteurization samples of milk are taken every three hours from each reservoir, and during the bottling process samples are selected from each lot. Packaged dairy products are dispatched to the warehouse where the seams of glued cartons and the sealing on the glass bottles with aluminum caps are also inspected. The techniques for selecting samples and inspection vary, depending on the nature of the food products. For example, the sampling of sour milk beverages is conducted via thermostatic or reservoir methods.

The end quality control of a typical food product is carried out in the following order. The shift foreman or engineer presents a product lot for inspection after it has been processed, bottled and packaged, stacked into containers, marked and refrigerated. From each product lot, a sample is selected for physical-chemical and organoleptic evaluation. On the basis of these analyses, the product is graded. In the absence of grades, the compliance of products with the pertinent standards is determined. If the standards are met, then a quality certificate is prepared, granting the enterprise the right to distribute the product within a specified time period. For milk products it is 18

hours, for sour cream 24 and for cottage cheese 18 hours. A lot may only be cleared for distribution with the approval of the laboratory manager and a statement from the OTK about the product's grading. If subsequently, defects are discovered, the entire shipment will be returned to the enterprise.

Compliance with sanitary-hygiene regulations during production is essential in the Soviet food industry. All producers are expected to clean glassware and production equipment. Special high quality cleaning and disinfectant solutions are used in Soviet plants. The concentration and temperature of cleaning and disinfectants are closely monitored. Also carefully controlled is the supply of hot water and steam, the effectiveness of ventilation and the disposal of trash and wastes. The personal hygiene of the work force also receives special attention. Each month, an evaluation of the sanitary conditions of the enterprise as a whole, as well as its individual shops and laboratories, is conducted by an in-house team, including a representative from the OTK and outside inspectors. The evaluation is based on a point system with demerits for violations.

Aside from quality controls inside the plant, there are independent organizations such as Gosstandart's Product Acceptance Department (Gospriemka)[1] or Ministerial Glavks. The State Department of Product Acceptance at Enterprises, subordinate to Gosstandart, plays an especially important role in assuring quality control. The Department can perform both spot inspections and announced inspections. When products are found that do not comply with established standards, the state acceptance department has the authority to refuse product shipments or suspend shipments until the breach is eliminated.

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[1]See footnote 1 on page 16 of Chapter I.

In addition to the State Acceptance group the union-republic ministries of trade usually house a body known as the Main Administration or Glavk for the inspection of the quality of foodstuffs *Glavnoye upravlenie gosudarstvennye inspektsii po kachestvu tovarov v torgovlie*. These Glavks can be found in every *oblast* and *krai* and are comprised of a small but experienced and qualified staff of government quality inspectors. These inspectors investigate enterprise conformance with food quality regulations in all branches of the food-processing industry. Occasionally, their investigations are spurred on by anonymous complaints.

2.3 Organization of Quality Control in a Non-Alcoholic Beverages Plant

As mentioned previously, the Soviets utilize the concept of critical control points to ensure the quality of raw materials or products. The first part of this chapter examined the organization of Soviet quality control inspections in the meat and dairy industries, including both control mechanisms within the plant and control procedures once the products are shipped from the plant. This section provides a more in-depth examination of "in-process" quality control in a non-alcoholic beverages plant. Before examining the specific critical control points, the reader should be acquainted with the basic processing steps for non-alcoholic beverages. In Figure 2.2 a diagram illustrating the processing of non-alcoholic beverages is presented. The production of non-alcoholic beverages is organized into six phases, A through E. These are described as follows:

Phase A:

Liquid sugar is brought to the plant in a tank truck. Using flexible tubing, the tank truck is connected to a pump and the liquid sugar, using heat exchange and the dispenser assembly is pumped to the storage facilities. The facilities are equipped with bacteriocidal lamps. Sacks of granulated sugar are piled on pallets. The sugar is weighed on the scales, and hoisted by a bucket conveyor into syrup-boiling kettle where water is added.

Phase B:

The sugar syrup is sent to the filter trap and then through a pump and heat exchange to the saccarose assembly. There, a measured amount of acid is added. The sugar syrup is cycled once more through the heat exchanger and finally is sent to the storage apparatus.

Phase C:

The ingredients of mixing syrup are stored in separate containers. Extracts are kept in cylinders, concentrates in larger containers, juices in barrels, compounds in cylindrical barrels and acids in special corrosion resistant receptacles. After weighing and filtration, the syrup is transferred either directly from its containers or through the pumps, to the tanks and placed in the pre-mixing area. Measured amounts of raw materials (juices, extracts) are added to sugar syrup in the mixing vat. After thorough mixing, the mixing syrup is transferred to the filter press via pumps. The filtered syrup is passed to the batch delivery-measurer of the mixing syrup and then, to the synchronous-displacement assembly for beverage preparation.

Phase E:

Empty glass containers are delivered to the factory and arranged on pallets. Forklifts are used to transfer the pallets to the warehouse. As

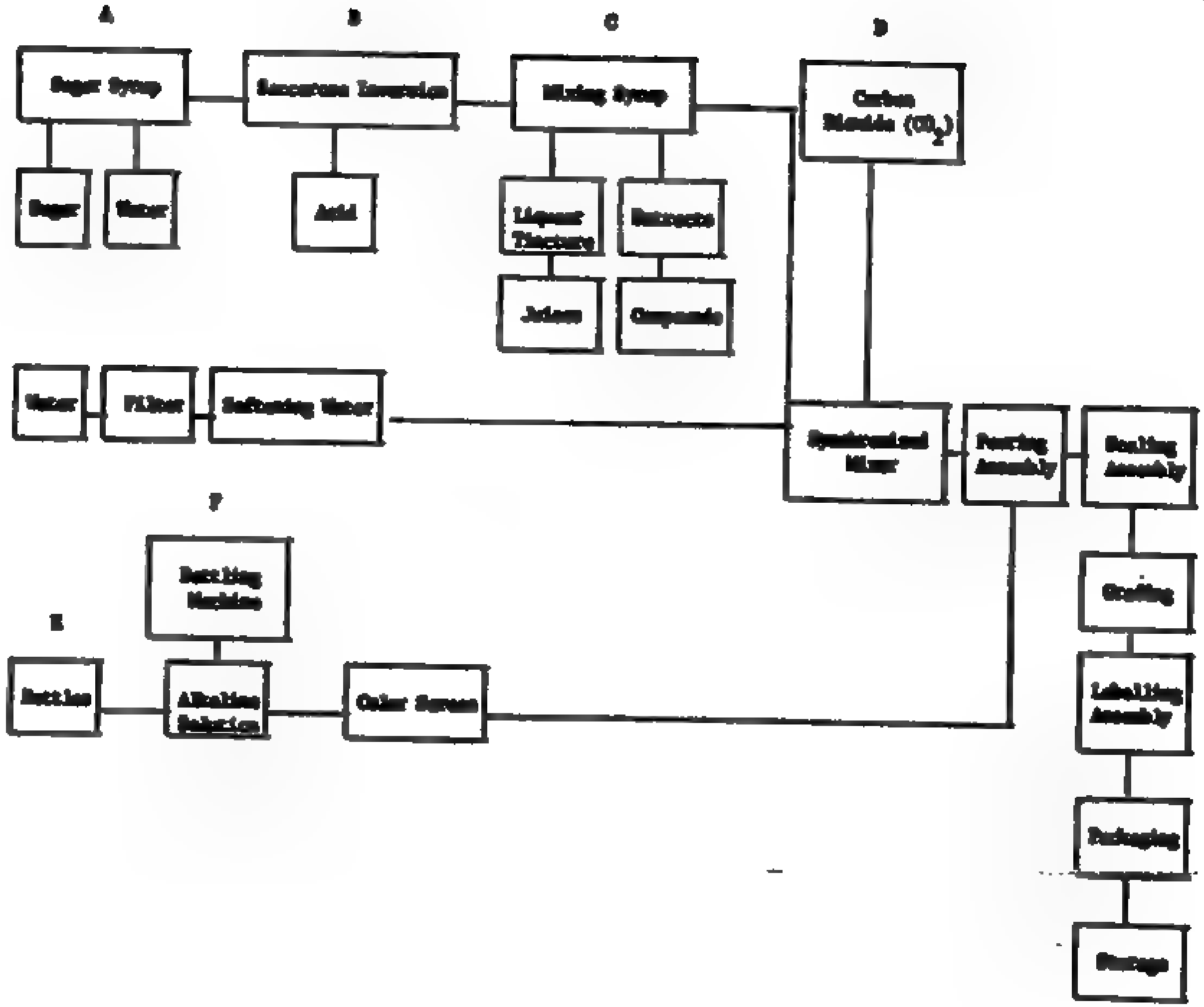

A
B
C
D
Sugar Syrup
Sugar
Water
Acid
Mixing Syrup
Liqueur Tincture
Extracts
Juices
Compounds
Carbon Dioxide (CO_2)
Water
Filter
Softening Water
Mixer
Pouring Assembly
Sealing Assembly
Labelling Assembly
Packaging
Storage
F
Bottling Machine
E
Bottles
Alkaline Solution
Color Screen

Figure 2.2

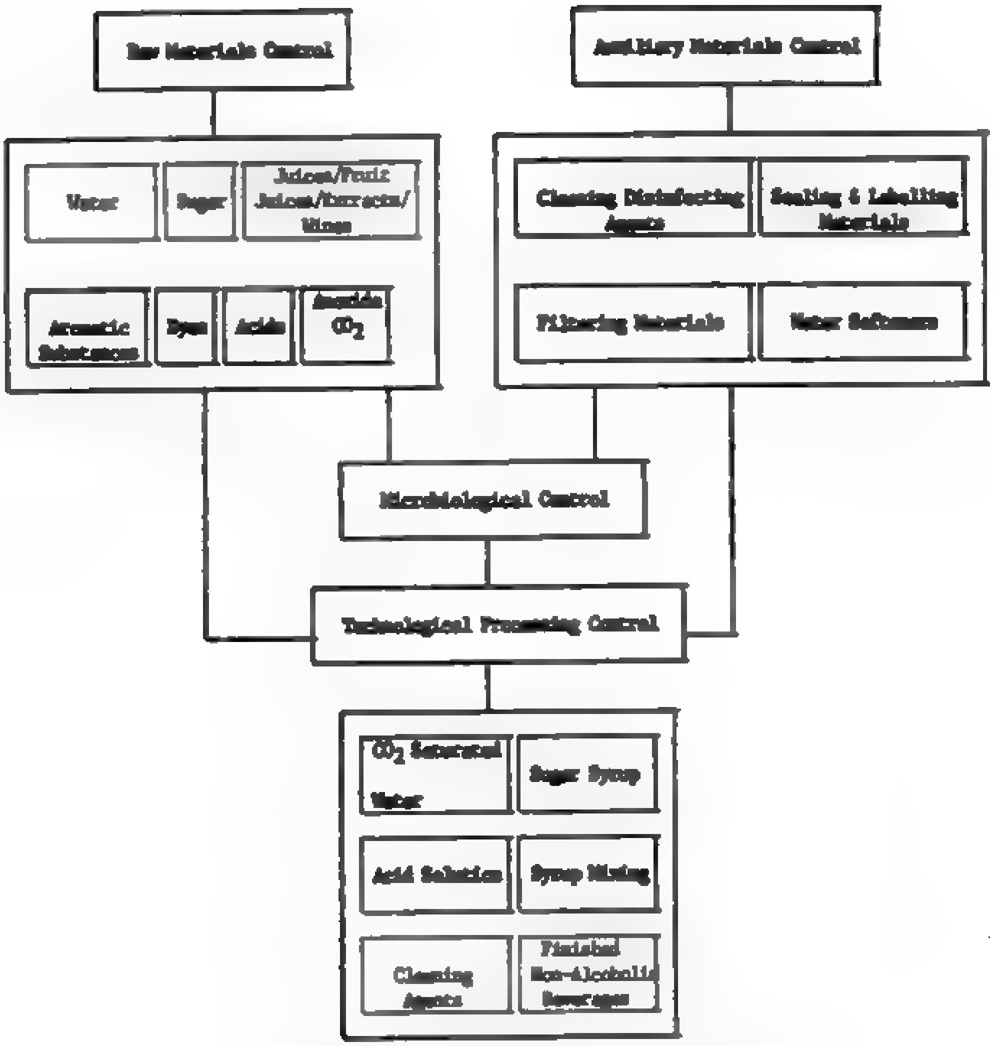
they are needed, the boxes are placed on the conveyor belt, and passed through an automated machine which removes the bottles from the boxes. The empty boxes are transferred by conveyer belt to the automated box packer, and the empty bottles are sent by conveyor belt to the bottle washing machine.

<u>Phase F</u>:

Clean bottles are transferred by conveyor belt through the light screen, pouring, grading and labelling machines and finally to the bottle packing machine.

Now that the reader is familiar with the basic production processes, the critical control points for ensuring quality may be identified. Figure 2.4 depicts four critical quality control points in the processing of non-alcoholic beverages: raw materials control (water, sugar, juices, extracts, wines, aromatic substances, dyes, acids, anoxide and CO_2) auxiliary materials control (cleansing/ disinfecting agents, sealing/labelling materials, filtering materials, water softeners) microbiological control and technological processing control (CO_2 saturated water, sugar syrup, acid solution, syrup mixture, cleaning agents) and finished alcoholic beverages.

The most complicated controls relate to the technological process. It is important that the controls are performed by regular and systematic sampling. In Table 2.1, the separate sampling tests are presented. The table notes the elements that are tested as well as the frequency of these tests. For example, each batch of sugar syrup is inspected for its dry solids content, temperature and the acidity of inverted syrup. Cleaning solutions are also tested -- at least three to four times during the eight hour shift to ensure proper temperature and alkalinity.



Critical Control Points in the Processing of Non-Alcoholic Beverages

Figure 2.3

Test Element	Control Indicators	Frequency of Control
Potable water	Color, smell, taste, presence or iron, active chlorine content, temperature stability and CO_2 content	2 times per shift[1]
CO_2 saturated water	Temperature and CO_2 content	3 times per shift
Sugar syrup	Dry solids content, temperature and acidity of inverted syrup	Each batch
Acid solution	Acid content	Before mixing each batch
Mixing syrup	Taste, smell, color, aroma, acidity and dry solid content	Before mixing each batch
Cleaning Solutions	Temperature and alkalinity	3 to 4 times per shift
Finished non-alcoholic beverages	Taste, color, smell, aroma, acidity, dry solids content, inverted sugar content and CO_2 content and stability	Each outgoing batch

Table 2.1

Sampling Schedule for Non-Alcoholic Beverages

[1]A shift is eight hours

The samples obtained during production of the beverages are sent to OTK laboratories for analysis. Occassionally, laboratories outside the plant are used when in-house facilities are backlogged. In fact, one of the greatest problems plaguing the Soviet food-processing industry has been slow turnover time of laboratory tests. Conventional testing procedures are generally cumbersome and time consuming. One example is the method of determining the percent of inverted sugar syrup during the production of non-alcoholic beverages. The test requires on the average two to three hours to complete. As a shift is eight hours and several batches are prepared during each shift, a two to three hour test does enable effective control. By the time the test indicates a problem, it is already time to prepare the next batch. This led the author to develop a simplified and rapid method for measuring the percent of inverted sugar in syrups. The new method required only eight to fifteen minutes utilizing volume ratios rather than weight measurements which are far less complex. The author's method was adopted as an enterprise standard and was under review for possible adoption as a republic standard.[1]

[1]When the author applied for his emigration visa, he lost his job. Thus, his method for measuring the percent of inverted sugar syrup was never adopted as a republic standard.

CHAPTER III

METHODS OF PRESERVING AND EVALUATING THE QUALITY OF FOODSTUFFS

3.1 General

Soviet food-processors employ a variety of preservation techniques to improve the quality of foodstuffs and prolong their storage lives. Food preservation technology has been studied extensively by the leading scientific research institutes (MTIMMP, OTIKhP, LTIKhP) of the Soviet food-processing industry. In addition to the emphasis on food preservation technology, Soviet specialists have developed an array of tests (chemical, microbiological, physical) to analyze the content. This chapter examines both contemporary Soviet food preservation technology as well as the preferred methods of evaluating the content and quality of foodstuffs.

3.2 Soviet Food Preservation Techniques

In developing modern food-processing technology, Soviet specialists strive to ensure that foods retain their natural flavor, appearance, aroma and nutritient value. Although the preservation technology is crucial in achieving this goal, reliable packaging and transportation are also important. The following sections describe the principal Soviet food preservation techniques.

3.2.1 Physical Preservation Techniques

Physical preservation techniques include pasteurization, ionization and exposure to ultraviolet rays. All of these techniques destroy microflora and retard ferments in food products. To inactivate ferments

and slow the growth of microflora, primarily molds, yeasts, non-spore carrying microorganisms and spore-carrying bacteria cells, pasteurization is carried out at temperatures less than or equal to 100°C. There is, however, no guarantee that all of the microorganic spores will be destroyed during pasteurization. Consequently, many foodstuffs, even after repeated pasteurization, may only have limited shelf lives. This is true of foodstuffs even when stored at low temperatures as well.

Two methods of pasteurization are used in the Soviet food-processing industry: a short process and a long process. During the short process, the product is subjected to a temperature of 90°C for 30 to 60 seconds. In contrast, with the long process, a temperature of 65°C is used and continued for 25 to 30 minutes. Both the short and long processes may be repeated to ensure a reasonable shelf life. Pasteurization may be conducted as many as two to three times until the product is completely sterilized. Products usually pasteurized in the Soviet Union by the above-described treatments include milk, juices, jams, marinades, fruit and berry compotes.

The most technologically-sophisticated technique of preservation used in the Soviet food-processing industry today is called the asceptic method. Asceptic methods of sterilization in the Soviet Union are typically used for liquid and pureed foodstuffs, including tomato paste, milk and fruit juices. The advantage of asceptic treatments is that the product's exposure to heat is shorter compared to other methods of heat treatment. As a result, a greater portion of its nutritient value is preserved. Once the products are cooled, they are packaged, usually in polymer materials, which are relatively inexpensive, but safe and effective.

Soviet food-processors also employ low temperature preservation

techniques for perishables. Low temperatures cause only minimal change in the chemical composition of foodstuffs. In the Soviet Union, food products are stored at near cryogenic temperatures--the temperature at which protoplasm freezes. This temperature varies for different food products and depends on the composition and concentration of dry substances contained in the product. For instance, apples fluctuate from -1.40° to -2.8° C, whereas onions, fish and meat are constant at -1.6°C, -2.°C and -1.2°C, respectively.

Fluidization is a widely employed method of rapid-freezing in the Soviet Union. This technique utilizes an intense flow of cold air for quick freezing of products. Foodstuffs prepared in small and individual units, such as green peas, artichokes, strawberries and rasberries are typically frozen in this way. A variety of rapid-freezing equipment is used in the Soviet food-processing industry, including tunnelated and contact. Tunnelated equipment directs a flow of cold air at the product, whereas, contact, as it sounds, freezes foods upon contact. The duration of freezing depends on the technique employed and product size. With the tunnelated method, for example, rasberries require 4 minutes, while tomatoes require 30 minutes. Once frozen, the product acquires a fine-grained crystalline structure. It should also be noted that because this freezing process does not break the individual units apart, Soviet food-processors are able to use automated packaging machines.

Soviet researchers A. A. Kolesnik and Nevol' Nichenko at the Leningrad Institute of Refrigeration have concentrated on the specific problems related to quick freezing at especially low temperatures--from -80° C to -90° C -- by the contact method and liquid nitrogen. These specialists determined that the advantage of this method is that the original quality of the products is maintained and moisture loss is kept

to a minimum. For most products, moisture loss is approximately 0.25%, as opposed to 1.8% for freezing via tunnelated equipment. The disadvantage of this method is its high cost.

Sterilizing filters are occasionally employed in the Soviet food-processing industry to ensure maximum preservation of vitamins, color, taste and aroma. These filters are used to capture microorganisms in clear juices, grape wines, beer and other beverages. A product is filtered through miniscule pores which catch most of the microorganisms.

3.2.2 Ionization Preservation Techniques

Gamma rays are also used in the Soviet food-processing industry to treat foodstuffs. Gamma rays are of special interest because of their high penetrative capability which allows large, well-sealed products to be treated. Radioactive isotopes of cobalt (cobalt 60) and cesium (cesium 137) along with mixed isotopes formed in the decay of uranium 235 are the principal sources of gamma rays used in the Soviet food-processing industry. Of all the ionized beams, however, radioactive gamma rays have the greatest practical value. Gamma rays, depending on the dosage, can bring a partial or complete halt to microorganic activity.

To date, the Soviet Ministry of Public Health has endorsed a radiation dosage of 0.6 to 0.8m rad. for some food products such as meat by-products packaged in plastic wrap. It is also worth mentioning that as of yet there is no substantial evidence indicating that ionization preservation techniques have had adverse effects on the human body. Practical application of gamma rays continues to be investigated by the leading scientific research institutes involved in the study of food preservation technology, including VNIIMP and LTIKhP. The principal

drawback, however, contines to be its high cost.

3.2.3 Ultrasound Methods of Preservation

Currents generated by ultra-high (UH) and super-high frequencies (SHF) are also used to preserve food products. When products are placed in a high frequency electromagnetic field with a variable current, the activity of charged particles is increased. This causes the temperature of the food product to rise as high as 100°C or more. In contrast to pasteurization, UH and SHF heats the entire product evenly, and thus, the heating speed is not influenced by the product's heat conductivity. Using the SHF field at 145°C, meat and fish can be sterilized in three minutes, whereas conventional pasteurization techniques would require 40 minutes at a continuous temperature of 115° to 118°C. The SHF method is used in the Soviet produce industry to sterilize fruit and vegetable juices.

Ultraviolet (UFL) irradiation falls within the invisible light ray spectra with a wave length of 60 to 400 nms, and kills any microflora present on food products. In the Soviet food-processing industry, UFL is applied to sterilize the surface of meat carcasses and sausage products, since penetration does not exceed 0.1 mm. Caution must be exercised in using this preservation technique, however, as UFL rays are harmful to the human body and can damage the kidneys and eyes. Government regulations mandate that all technicians utilizing UFL wear protective goggles and suits. Nevertheless, it is, by far, one of the most efficient methods of food treatment.

3.2.4 Chemical Methods of Food Preservation

Chemical additives used in the Soviet food industry are selected on the basis of their ability to preserve the natural taste, color and

aroma of foodstuffs. At present, the most commonly used chemical additives certified by the Soviet government for use in food preservation and processing include: ethyl alcohol, acetic, sulphuric, sorbitic and boric acids, some salts, urotropin, benzoin or urobromin, as well as some antibiotics such as tetracycline.

Admixtures of acetic acids or marination preserve the foodstuffs by increasing their acidity. At concentrations of 1.2 to 1.8%, acetic acid inhibits the growth of many microorganisms, primarily the putrefacient varieties. It is not uncommon to combine acidic admixtures with other preservation techniques, such as pasteurization or curing. Products typically marinated include: fruits, vegetables and mushrooms. Ten days to two months are required for marinated products to ripen. During the ripening process, acetic acid, sugar and salt are abosorbed by the product. Approximately 75% of the saracose is converted into inverted sugar, improving product taste. Marinated products are stored at relatively low temperatures, ranging from 0° to 4°C.

Sorbitic acid additives have been approved by Gosstandart for use in the preservation of foodstuffs. The allowable levels are presented in Table 3.1 below:

Product	Approved Levels of Sorbitic Acid, 1 mg. per 100 grams
Non-alcoholic beverages	30.0 - 50.0
Fruit-berry juices	100.0
Confectioneries	120.0
Soft caviar	120.0
Cheese	200.0/surface treatment
Semi-smoked sausages	500.0
Condensed milk	100.0

Table 3.1[1]

Approved Sorbitic Acid Levels in Different Foodstuffs

[1]The data presented in Table 3.1 was excerpted from the Soviet GOST on the chemical composition of foodstuffs.

After foodstuffs have undergone the required processing, they are submitted to the plant's laboratory which is responsible for collecting and testing samples. It should also be noted that foodstuffs are tested during the actual processing as well. An example of this was described in Chapter II with a non-alcoholic beverage plant. The next section will examine the methods preferred by Soviet specialists for appraising the quality of food products.

3.3 Organoleptic Appraisals of Quality

In the Soviet food industry, both organoleptic and laboratory methods of evaluation are employed to compile composite quality indicators. These tests have been standardized so that the results of analyses performed in different laboratories may be replicated. Organoleptic appraisals of quality (that is, by the sensory organs such as taste tests) play an essential role in grading the quality of foodstuffs. The organoleptic method of sample testing is widely used for quality evaluations in all branches of the Soviet food-processing industry. For the past decade, this method has been coined "sensory analysis," and examines appearance, taste, consistency or aroma of foodstuffs. Sensory analyses are conducted primarily during the initial phases of food-processing.

Because it is difficult to seperate the sensations of aroma from taste, the term "flavour" is used to described the combined senses of taste and smell. In organoleptic quality appraisals, four basic flavours are distinguished: sweet, salty, sour and bitter. All other types and nuances of taste are combinations, such as bitter-salty, sweet-sour, and so on. The speed of taste perception varies for different senses. Saltiness tends to be detected the fastest, then sweetness and finally, bitterness.

The organoleptic evaluation is especially important for the quality of appraisals of products such as grape wines and tea, where complex chemical analyses cannot provide accurate data on marginal differences in taste. For instance, many chemical agents are added to beverages and can alter the taste and aroma of wine. Chemical tests do not reflect aromatic changes in the product. The advantage of the organoleptic method also lies with its speed. A mere sixty seconds is sufficient to determine the suitability of the tea sample with respect to standard organoleptic indices (appearance, taste, aroma, color and infusion of the brewed leaf).

Food product quality is established first and foremost on the basis of appearance. Color, for example, is one of the vital sensory tests of organoleptic evaluations. Touch can determine the texture of many food products: the fineness of chopped onions, the elasticity of refrigerated meats and the like. The examiner can determine the consistency of foods, their elasticity, juiciness, structure and delicacy through taste tests. Of all of the organoleptic indices, however, taste and aroma are valued most important in organoleptic ratings. Almost all food products have an aroma and subtle differences in aroma may indicate their nature, freshness and quality.

3.4 Laboratory Appraisals of Foodstuffs

A variety of chemical and biological methods are used in the Soviet food-processing industry to determine the suitability of specific food products for industrial processing and human consumption. Chemical, microbiological, bacteriological and physical tests are employed to determine the content and quality of foodstuffs in the course of processing. All test results are quantified so as to allow comparison. The quality

of foodstuffs, however, cannot be judged exclusively by laboratory research. Objective appraisals are compiled from both laboratory tests and organoleptic analyses.

In the Soviet Union there are some disadvantages to laboratory testing. Laboratory testing requires specialized equipment which in the Soviet Union is in short supply. Also, laboratory tests are more time-consuming than other methods of analysis such as organoleptic evaluations. When possible, Soviet technicians utilize physical tests since they are less time consuming than chemical examinations. For example, only a few minutes are required to measure the refraction of light, flourescence and absorption of infrared light by the product, thereby determining its moisture, protein and fat content. Another example is an infrared analyzer which is used for rapid and thorough analysis of milk. Some of the analyzers are automated to provide print outs of measurement readings, freeing the technicians from time-consuming calculations and documentation tasks. Unfortunately, however, much of the equipment is designed to analyze only a single element of a product and thus, has a limited value.

The relative gravity of a product, its melting and freezing points are computed by areometers, pycnometers and hydrostatic scales. Thermal constants which relate to the quality of different fats and then purity can also be determined. Chemical analyses measure the amount of mineral substances in liquids, sugars, fats and vitamins. As there are standards in the Soviet Union regulating the chemical composition of foodstuffs, chemical analyses verify plant compliance with State regulations on the chemical composition of foods.

3.5 Equipment for Testing Food Quality

Soviet specialists are experimenting with a variety of diagnostic

equipment to test the quality of foods. Based on the author's experience, it seems as though the majority of the food quality test equipment is optical-oriented. The author recalls only a few instances in which the electrical properties of foodstuffs could be tested.[1]

Basic equipment such as refractometers for determining the volume of fat, moisture, alcohol, sugar contained in a food product is available to most average-sized plants and enterprises of the Soviet food-processang industry. Refractometry is based on a product's capacity to refract light when immersed in a liquid. Similarly, saccharimeters are also widely available for measuring the sugar content of foodstuffs.

Technologically-sophisticated equipment for testing the quality of foodstuffs, such as spectrophotometers, colorimeters and chromographs, many imported from the West, are only available in the leading Soviet scientific research centers, including VNIIFTRI, VNIIM and VNIIMash. The Soviet food-processing industry has been slow to reproduce such equipment in large quantities. Another hindrance, which by the way is typical of many branches of Soviet industry, is that when equipment is imported for use in Soviet industry, there is only a handful of people qualified to train personnel on its use. Consequently, many rubles have been wasted purchasing foreign equipment rather than developing indigenous technology.

As mentioned above, spectrophotometry is viewed as one of the most advanced technologies for evaluating the quality of foodstuffs. Spectrophotometry is used primarily for agricultural products which

[1]Editor's Note: It should be noted that the author was unable to provide any details on the application of X-ray or microwave equipment for testing the quality of foodstuffs in the Soviet Union. These technologies are fairly widespread in the United States. This is not to suggest that such equipment is unavailable in the USSR, but simply that the such equipment is in limited supply.

transmit light at certain wavelengths. Top-of-the-line Soviet spectrometers have an accuracy of +0.1 - 0.5 relative %. One advantage of spectrophotometric methods is that it is possible to test a multi-component substance, whereas other methods such as colorimeters are only capable of analyzing a single substance. Spectrophotometry is also used in the Soviet food-processing industry to analyze dying agents in the ultraviolet or near-infrared spectrum. For example, spectrophotometric and photocolorimetric methods can determine the cyanin in grape wines, the caffeine in tea and coffee, the theobromines in cocoa and dying agents in fruits. Spectrophotometers were designed in response to the need to simplify the process of analyzing the quality of food. Before spectrophotometers were invented, technicians had to be experts in diverse scientific disciplines such as optics, electronics and computer science. Spectrophotometers enable the automation of many time consuming routine processes. An example of an advanced spectrophotmeter is presented in Figure 3.1 below. (Other illustrations of Soviet equipment for testing the quality of foodstuffs are appended to this monograph.) The 7-SF-4A spectrophotometer has many of the same features that spectrophotometers developed in the West have, including light filters,

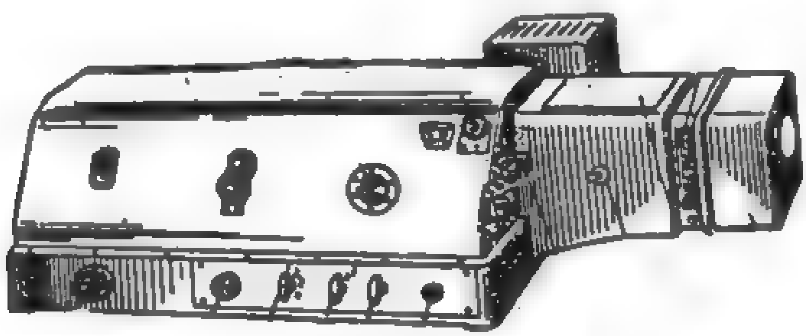


Figure 3.1

7-SF-4A Spectrophotometer[1]

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[1] Editor's Note: The author was unable to provide comparative information on different classes of spectrophotometers or a precise assessment of the 7-SF-4A's sophistication.

condensors and various measurement functions. It should be kept in mind, however, that such equipment is generally available only in the leading scientific research centers.

3.6 <u>Quality Appraisals: The Soviet Point/Grade System</u>

The Soviet quality grading system for food products divides products into three basic categories, the designation of which is among the responsibilities of Gosstandart. The three categories are highest, first and second. Products ranked "highest" generally exceed the minimum requirements for that product or product-line. Products in the highest category are also considered to be competitive with similar products produced in the West and as such are granted export rights. First category products meet all of the pertinent requirements of all standards, including enterprise, industrial branch and national, but are not considered especially advanced. Finally, second category products generally indicate that the product is substandard and that it should be removed from production.

Two appraisal systems are employed by the Soviet food-processing system. The first type only takes into consideration organoleptic indicators, including appearance, taste, aroma color and the like. The other grading system examines the chemical composition. Together, the two types of quality grading systems provide a comprehensive appraisal of product quality.

The point system is the preferred method of grading products in the Soviet food industry. In this system, each quality indicator, for example, consistency, is allotted a fixed number of points which reflects its individual importance for product quality. In organoleptic appraisals, 40 to 50% of the points are usually allotted to product taste and aroma. Other indices are ranked according to their particular

importance for the food product being evaluated. For example, an important quality indicator for carbonated fruit beverages is the degree of saturation of the carbonic acids, which can account for up to 35 points. In contrast, color indicators for those beverages can attain only a maximum of five points. The maximum number of points awarded to any product varies. Gosstandart has authorized 10, 25, 30, and 100-point rating systems.

Soviet rating systems utilize a scale of values which is created for each indicator. After deductions are made for flaws, the total number of points is tallied. The total number of points scored by a product determines its classification as highest, first or second. Butter is awarded the highest mercantile classification if it receives a rating between 88 and 100 points, with no less than 41 specifically for taste and aroma. The indicators for butter and their respective point values are presented below in Table 3.1.

Indicator	Point Value
Taste and Smell	50
Consistency	25
Color	5
Packaging	10
Saltiness	10
Total	100

Table 3.1

Quality Rating System for Butter

First grade butter ranges from 80 to 87 points, with taste and smell receiving no less than 37 points. Butter assigned a grade of less than

80 points is considered substandard.

In accordance with Soviet standards, the freshness of meat is appraised on the basis of a 25-point system. Meat receives a rating of highest if it attains a score between 21 and 25, first if it scores between 10 and 20, substandard and second if it achieves a value of 9 or below. The point values assigned to the various indicators are designated in Table 3.2. As shown in the table, the greatest number of points (13) are alloted to organoleptic indicators. The remaining points are distributed among the chemical and microbiological indicators. The number of points assigned to each indicator is based on extensive studies performed by Soviet scientists.

Indicator	Point Value
Organoleptic	13
Amount of volatile fatty acids	4
Reaction with sulphate copper in broth	4
Amino ammoniac nitrogen	2
Bacterioscope	2
Total	25

Table 3.2

Rating System for Meat

In Table 3.3 a more detailed description of the rating system for bacteriological indicators of the freshness of meat is provided. Table 3.3 indicates that the maximum number of points alloted to bacteriological indicators is two. Thus, for example, fresh meat is likely to be awarded a rating of two, confirming that no microflora are found, or if the meat has begun to spoil, then it may be assigned 1 or even 0 points (See Table 3.3) depending on how much it aged.

Bacterioscopic Findings	Point rating
No microflora found in smears, but cocci or bacilli may be detected. No residue from decaying tissue.	2
Some cocci (20-30); a few bacilli in the field of vision. Micro-organisms, muscle decay clearly seen.	1
Many microorganisms on the smear; bacilli predominate (they cover almost all the field); much decomposed muscle tissue.	0

Table 3.3

Bacteriological Indices for Grading Meat

GOST 7269-79 regulates the methods for determining the freshness of meat. Effective for five-year intervals, the standard is reviewed and modified after each five-year period. Failure to comply with the standard may result in prosecution. The standard applies to beef, lamb, and pork meat and meat as well as other types of slaughtered livestock, and by-products (excluding liver, brains, lungs, spleen, and kidneys).

In accordance with GOST 7269-79,[1] the following sampling procedures for determining the freshness of meat have been established.

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[1] The following description of sampling and testing procedures for meat and meat by-products was excerpted from the GOST 7269-79.

Sampling Procedures

I. Samples are taken from each meat carcass under examination or parts thereof. A piece no smaller than 200 grams should be extracted from the following places:

- in the neck, against the 4th and 5th neck vertebrae
- in the area of the shoulder
- in the area of the demur and fatty muscle tissues

II. Samples of by-products under examination are taken with a mass of no less than 200 grams in the area of the femur and fatty muscle tissues.

III. Samples of frozen or refrigerated blocks of meat and by-products or from separate blocks of doubtfully fresh meat are cut as a whole piece with a mass of no less than 200 grams.

IV. Each sample is packed in parchment in accordance with GOST 13412-74, cellophane film in accordance with GOST 7730-74, or food service polyethylene film in accordance with GOST 10354-73. A label should be inserted on or under the parchment, written in pencil, indicating the name of the tissue or organ and number of the carcass, received at acceptance. Samples taken from the same carcass are packed together in a paper package and placed in a covered metal box. A document is attached to the samples and sent to the laboratory for analysis with the following information:

- date and place of specimen-taking
- type of livestock

- carcass number which is acquired at acceptance
- reason for testing
- source of problem (if applicable)
- signature of consignor

V. Before the samples are submitted to the laboratory for testing, they are packaged separately in parchment and wrapping paper. Inscriptions on each sample and on the accompanying documentation are applied as described above. The box carrying the specimens is sealed.

In addition, GOST 7269-79 provides for the following test methods.

<u>Testing methods</u>

I. Organoleptic methods are used to determine the appearance, color, consistency, smell, condition of the fat, condition of the tendons, transparency and aroma of the bouillion. Each sample is analyzed separately.

II. Equipment, materials and reagents:

- Laboratory scales in accordance with GOST 19491-74
- Routine meat grinder in accordance with GOST 4025-78 or routine electric meat grinder in accordance with GOST 20469-75
- Electric water bath
- Scissors in accordance with GOST 21239-77
- Measuring cylinders of 25 ml. capacity in accordance with GOST 1770-74
- Watch glass
- Glass rods
- Conical, model KP-100 in accordance with GOST 10394-72

- Filter paper in accordance with GOST 12026-76
- Distilled water in accordance with GOST 6709-72

III. The appearance and color of the carcass are determined by expert inspection. The appearance and color of a cross section of muscles is ascertained in the deep layers of muscle tissue on a freshly sliced cut of meat. The presence of gumminess is found by probing, and the surface moisture of the meat on a cut by pressing a piece of filter paper to the cut.

IV. Determination of consistency.

On a fresh slice of the carcass or tested sample, a small depression is made with the finger and its smoothing out is examined.

V. Determination of smell.

The smell of the surface layer of the carcass or tested sample is determined organoleptically. Then, with a clean knife, a cut is made and the smell in the deep layers is immediately determined. During this process, special attention is paid to the muscle tissue adjacent to bones.

VI. Determining the condition of the fat.

The condition of fat (color, smell, and consistency) is determined in the carcass at the time of the sampling.

VII. Determination of the condition of tendons.

The condition of the tendons is determined in the carcass at the time of sampling. By touching the tendons, it is possible to determine

elasticity, density and the condition of the superficial vescicular surfaces.

VIII. Determination of transparency and aroma of the bouillion

IX. Preparation for testing.

To obtain uniform samples, each sample passes through a meat grinder with 2 mm grating and the meat is thoroughly mixed. 20 grams of the meat is weighed out on the laboratory scales, which have an error margin of no more than 0.2 g. The sample is then placed in the 100 ml. conical container, and 60 ml. of distilled water is added. The ingredients are thoroughly mixed, and the container is covered with a watch glass and placed in the boiling water bath.

X. Execution of the tests

The smell of the meat bouillion is determined while the sample is warmed to a temperature of 80°C to 85°C. The steam emits from the partially open watch glass. To determine transparency, 20 ml. of bouillion is poured into a 25 ml. capacity measuring cylinder with a 20 mm. diameter. The degree of transparency is established visually. On the basis of test results, conclusions are made about the freshness of the meat or by-products in accordance with characteristic guidelines presented in Table 3.5. When the freshness of meat or by-products is questioned as a result of a single indicator it must be subjected to chemical and microscopical analysis.

When there is a discrepancy in the results of organoleptic and chemical or microscopic analysis, new samples are selected and chemical tests are repeated. Secondary analysis results are always viewed as final.

Indicator	Characteristic of Meat or By-product		
	Highest (Fresh)	First (Freshness is Questioned)	Second (Spoiled)
Exterior appearance, color of carcass surface	Slightly dried crust of pink or red defrosted carcasses: red, soft fat, partially colored bright red.	Moist in places, slightly gummy, sweaty.	Very dried covered with gray-brown color or moldy.
Cut muscle	Slightly moist, leaves no wet on filter paper; characteristic of given type of meat. Beef: light to dark red. Pork: light pink to red; lamb, red-cherry red; baby lamb, pink.	Moist, leaves moist spot on filter paper; slightly sticky, dark red color. For defrosted meat, slightly muddy colored meat juice leaks from cut surface.	Moist, leaves a spot sticky, red-brown color. For defrosted meat, muddy colored meat juice leaks from cut surface.
Consistency	Cut meat is firm, elastic; depressions quickly smooth out.	Cut meat is less firm and elastic depressions smooth out slow within 1 minute; fat: soft; defrosted meat slightly distended.	Cut meat is flaccid depressions do not smooth out; fat: soft; defrosted meat is loose and sedimented.
Smell	Specific, particular smell for each kind of fresh meat.	Slightly acid or musty.	Sour musty or moldy.
Condition of fat	Beef: white, yellowish or yellow color; hard consistency; when pressed, it crumbles. Pork: white or pale pink, soft, elastic; lamb: white, firm. Should have no rancid or sour smell.	Grey, dull tinge slightly sticky to the touch; can have a slightly rancid smell.	Grey, dull tinge, upon pressing, smears. Pork fat can be covered.
Conditions of tendons	Elastic, firm, surface of veins is smooth, shiny. Defrosted meat: soft, flaccid, dark red.	Less firm, dull white. Surface of veins is slightly covered with mucus.	Muddy, with large amount of lumps, with a sharp, unpleasant smell.
Transparency and aroma of bouillion	Transparent, aromatic.	Transparent or muddy, with a smell uncharacteristic of fresh bouillion.	Muddy, with large amount of lumps, with a sharp, unpleasant smell.

Table 3.5

Indicators for Determining the Freshness of Meat

CHAPTER IV

SOVIET FOOD PACKAGING, STORAGE AND TRANSPORTATION PRACTICES

4.1 General

The problem of losses and damage to food products while in storage, which for agricultural products has amounted to as much as 15-20%,[1] has been studied extensively in most of the leading scientific research institutes of the Soviet food-processing industry. Improving the delivery and storage of agricultural and industrial products is crucial and up until now has not been assigned a top priority by Soviet authorities in the food industry. One of the greatest difficulties confronted by Soviet scientists in their efforts to develop more effective storage procedures is that each food product requires special packaging and handling. Thus, perishables must be chilled or frozen while dried foods must be stored at room temperature.

In the Soviet Union, basic foodstuffs are stored in warehouses or other specially-designed storage facilities. A severe shortage of specialized warehouses, however, has left food processors with little choice but to rely on makeshift storehouses or cellars which are modestly equipped. Insufficient supplies of refrigerators and freezers as well as the slow pace of constructing modern food warehouses in the Soviet Union contributes significantly to the relatively high losses of goods in storage. In fact, roughly 70% of the warehouses in use today were constructed two decades ago. Consequently, most of them are equipped with obsolete equipment that does not meet current Soviet storage regulations.

[1] This is the author's estimate.

In 1972 the Soviet Ministry of Trade enacted regulations on the minimum space requirements for food storage. So, for example, a town with a population of 1,000 must allocate no less than 60 square meters for food storage. Even if the space has been allocated, however, there is no guarantee that it will be equipped with the proper equipment. In this chapter, the author considers three additional aspects of quality control in the Soviet food industry: packaging, storage and transportation of foodstuffs.

4.2 Packaging Materials for Foodstuffs

Losses attributed to poor storage conditions can be minimized if the proper packaging materials are used. Packaging materials should prevent contact between the product and the surrounding air. In the Soviet food-processing industry, polymer film (polyethylene, polypropylene or a combination of these) is the most commonly used packaging materials. Half carcasses, quarters or selected cuts, for example, are usually packaged in a polymer wrap at normal atmospheric pressure, in a nitrogen-rich atmosphere or in a vacuum. It is well known that nitrogen-rich or vacuum methods of packaging significantly increase the shelf life of meats since they eliminate the chemical reactions in lipids and proteins.

Many foodstuffs are packaged in metal cans or glass jars. Metal cans are manufactured primarily from white tin (sheet metal with a thickness of .27 to .35 mm, covered with a thin layer of pure tin on one or both sides). Acidic goods such as berry products, vegetables and marinated foods are packaged in cans which are laminated. The enamel layer prevents the metal from dissolving or corroding. Enameled white tin is also used for canning meats, fish and other products with high

protein concentrations. When canning products which are high in protein, there is a high risk that a sulfurous reaction will cause a film of oxide tint to form on the inside of the can. While a layer of sulfurous tin does not alter the taste or nutritional value of the product, it does give the product an unappetizing appearance. According to Soviet State standards, there are 31 types of tin cans approved for packaging food products. These are differentiated by volume, linear measurement and shape. Each type of can is assigned an identification number.

Glass jars, although in many ways less desirable than tin as they are heavier and have a higher breakage rate, have the advantage of greater chemical stability, and can be used to package all types of foodstuffs. Moreover, glass jars, unlike tin cans, are reusable. The Soviet food-processing industry uses a variety of jars which have metal lids and ring-shaped rubber seals for hermeticization. The jars and seal are heat resistant, capable of withstanding high temperature sterilization as well as low temperatures in storage.

The Soviet canning industry manufactures containers (tin, glass) in a variety of shapes and sizes. Tables 4.1, 4.2 and 4.3 on the following pages present the GOST specifications for various containers, including the shape, length, width, height and volume. The specifications for these jars are recorded as State standards and are considered mandatory for all Soviet canning plants. The institute responsible for developing standards on the weight and content of containers used in the Soviet food-processing industry is the All-Union Scientific Research Institute for Metrology (VNIIM).[1]

[1]See Chapter I for additional description of this institute.

GOST can no.	Diameter (in mm.)	Height (in mm.)	Volume (in ml.)	Food product
1	72.8	24.0	104	meat
2	99.0	22.9	176.2	fish
3	99.0	31.9	250.0	meat & fish
4	72.8	61.9	258.0	meat
5	83.4	47.8	261.0	fish
6	83.4	49.4	270.2	fish
7	72.8	77.9	325.0	dairy
8	99.0	45.9	353.0	vegetable, meat, fish
9	72.8	89.9	375.0	vegetable, meat, dairy
10	74.1	112.2	483.9	fish
11	99.0	62.1	477.7	fish, vegetable
12	99.0	66.9	514.6	vegetable, meat, fish
13	99.0	111.9	860.6	all canned foods
14	153.1	164.8	3033.0	tomato, fruit, vegetable, meat, dairy
15	215.2	241.7	8794.8	fruit, dairy
21	99.0	15.9	127.0	fish, meat
22	74.1	32.8	141.6	fish, meat
23	71.5	90.9	365.4	fish
24	99.0	164.8	1319.1	fish
25	89.0	183.0	1405.0	fish
26	153.1	106.8	1930.0	fish
27	215.2	82.5	3033.0	fish

Table 4.1
GOST Specifications for Tin Cans

GOST	Container	Length (in mm.)	Width (in mm.)	Height (in mm.)	Volume (in ml.)
16	square	100.0	70.8	13.9	101.0
17	square	116.0	78.0	18.6	159.0
18	square	116.0	87.0	23.6	235.0
19	oval	150.0	64.0	26.0	227.5
20	ellipsoidal	160.7	107.7	31.1	430
28	square	96.0	43.0	13.0	54.0
29	square	116.0	78	25.3	218.0

Table 4.2

GOST specifications for Shaped Tin Cans (for fish)

Gost Number	Container Type	Empty Weight	Full Weight	Food product for which can is designed
70-1	glass	200	230±7	fruit, dairy
58-1	jar	200	230±7	fruit
83-5	jar	350	385±10	fish, tomato, fruit
83-1	jar	500	560±15	all goods except dairy
83-2	jar	1000	1030±20	same as above
58-2	bottle	500	560±15	fruit (primarily juices, compotes, tomato)
70-2 (flacon)	bottle	3000	3200±50	fruit, vegetable, marinades, tomato
83-3	bottle	3000	3200±50	same as above
70-3	bottle	10000	10450±150	tomato, marinades, pickled goods
83-4	bottle	10000	10450±150	same as above

Table 4.3

GOST Specifications for Glass Containers

4.2.1 Labelling Containers

The Soviets use quick-drying paint to mark the tops and bottoms of cans. Three to five symbols are placed on the bottom of the container: the first indicates the canning industry branch (R for the fish industry, MM for the meat and dairy industry, K for fruit and vegetable processing plants). The other symbols provide the plant identification and year of processing. For example, the stamp, "MM778" stands for Meat and Dairy Industry, "factory no. 77, 1988." Inscriptions are also made on the top of metal cans to indicate the shift, day and month of production. The shift is identified by a single digit and the day by two digits. Each month is marked a letter which are as follows:

- A for January
- B for February
- V for March
- Ḡ for April
- D for May

- E for June
- ZH for July
- I for August
- K for September
- [illegible] for October
- M for November
- N for December

Thus, for example, the code 2-7-B would indicate that the product was canned during the second shift on the seventh day of February.

Glass jar lids are not stamped. Rather, the required information is printed on the outer corner of a paper label. Contents and directions for preparation are also shown on the label. Labels are usually printed in non-running, heat-resistant inks. Labeled jars are packed in wooden crates or cardboard boxes with soft padding between the glass jars. The boxes are then affixed with control labels, indicating the appropriate designation. Some canned goods are designated as government reserve and earmarked for prolonged storage--two to five years. To prevent corrosion, labels are not affixed to these jars. Instead, the jars are coated with industrial paraffin and packed in crates or cardboard boxes. The labels are dispatched along with the batch of canned goods but in a separate box.

Canned goods are stored separately from other foodstuffs. A standard distance between rows is maintained. The average storage temperature for most canned goods ranges from 0°C to 20°C. At higher temperatures the contents of the cans may darken. The optimal storage temperature for meat products ranges from 0°C to 15°C, with a relative humidity not exceeding 75%; for dairy products, temperatures are maintained between 5°C and 12°C. The shelf life of meat and vegetable products kept under these conditions is usually no more than two years.

4.3 Storing Foodstuffs

The lag time between the processing and consumption of foodstuffs is known as the storage period. For some food products this lag time is brief, only a few hours (bread, milk, berries, leafy vegetables and other perishables). For other foodstuffs, such as refrigerated meat, sausage products, sour milk products and confectioneries the lag time or storage period may be several days. Fruits and vegetables in the Soviet Union are generally stored until the following harvest, which is usually several months. Some food products (grain, canned meat, sugar) are even stored for several years in government reserves.

4.3.1 Storage of Refrigerated and Frozen Meat

Stored meat is kept either refrigerated or frozen. Naturally there are tradeoffs between refrigerating and freezing. Because consumers in the Soviet Union generally prefer refrigerated to frozen meat, in the past fifteen years the Soviet meat and dairy industry has encouraged food processors to refrigerate rather than freeze meat. This effort, however, has been hindered due to restrictions imposed by slaughtering seasons, a limited supply of refrigerators and an insufficient number of refrigerated railroad cars for distribution. Another problem is that refrigerated meat cannot be stored beyond an average period of ten to fifteen days from the time of slaughter, whereas frozen meat can be stored considerably longer. Ten to fifteen days is generally not a sufficient amount of time to coordinate the distribution of meat and ensure its continued refrigeration until the time of sale.

Refrigerated meat is usually stored as carcasses and half-carcasses. Beef and pork carcasses are stored together and hung from hooks. Sheep

carcasses are stored separately in semi-drawn, semi-dressed forms on frames with ten to twenty carcasses per frame. Carcasses and half-carcasses should not be touching each other, and should be placed at least three to five centimeters apart. Refrigeration systems are usually pneumatic, although on occasion direct vaporization systems are employed. Meat is stored at 0° to -1°C with a relative humidity of 85-90% and an air circulation of 0.1 to 0.2 cubic meters per second.[1]

In 1977 the All-Union Scientific-Research Institute of the Meat Industry (VNIIMP) developed and introduced a special storage procedure for beef, pork and sheep in classed and assorted cuts. The meat is hung on posts over permanently-installed trays or pallets, and is kept this way for distribution and shipping to markets so as to facilitate rapid loading and unloading. Because the trays are stacked three-to-four deep, this method also enables a more efficient utilization of storage space. Soviet food-processors have also found that this technique helps to protect meat from shrinkage.

Meat is usually vacuum-packed and covered in polyethylene-cellophane wrap in cardboard, polyethylene, or metal containers and shipped to storehouses. At a storage temperature of 0°C cut meats can be stored from seven to ten days. If the meat is vacuum-packed with polyethylene wrapping, it can be stored up to 28 days at a temperature of 1° to 1.5°C.

Refrigerated poultry is usually hung in a chess board pattern so as to facilitate the air circulation. The temperature in the refrigeration chamber ranges from -0.5° to +0.5°C, at a relative humidity of 80 to 90%, and an air circulation of 0.2 to 0.3 cubic meters per second. Storage periods for semi-dressed and drawn carcasses span from ten to

[1]The air circulation rate may vary depending on the size of the refrigeration chamber.

twelve days, while for drawn and dressed carcasses packed in polymer film, it is only five to ten days.

Soviet norms for expected losses of refrigerated meat vary according to the type of meat and fat content. It is worth noting that meats with a higher fat content can be stored longer than meats with a lower fat content. For beef and lamb, the shrinkage norms for one storage day range from 0.42 to 0.60%, depending on the fat content, for two days 0.62 to 0.85% and for three days 0.72 to 0.90%. For pork, depending on fat content and age of the slaughtered animals, the norms are 0.2 to 0.4, 0.4 to 0.6, and 0.5 to 0.85%, for one, two and three storage days, respectively. Soviet norms for meat shrinkage norms for one storage day range from 0.42 to 0.60%, depending on the fat content, for two days 0.62 to 0.85% and for three days 0.72 to 0.90%. For pork, depending on fat content and age of the slaughtered animals, the norms are 0.2 to 0.4, 0.4 to 0.6, and 0.5 to 0.85%, for one, two and three storage days, respectively. Soviet norms for meat shrinkage in storage periods exceeding three days is calculated in a 0.02% increments. Vacuum packaging of meat reduces meat shrinkage considerably.

Soviet researchers have learned that high concentrations of CO_2 in the storage chamber can darken the meat color. For example, the concentration of CO_2 in the chamber where beef and lamb are stored should not exceed 20%. At the same time, a specified amount of CO_2 is needed to ensure reasonble shelf lives of meat. At a temperature of 0°C and 10% to 20% atmospheric CO_2, the shelf life of refrigerated meats is twice that of meats stored without CO_2. A team of specialists led by V. V. Stefanovich and F.F.Yasinetskii, at the Odessa Institute of the Food and Refrigeration Industry invented a device that automatically monitors and controls the concentration of CO_2. Recommendations were also made

for CO_2 refrigeration chambers using CO_2 gas on seafaring vessels in order to distribute refrigerated meat for the crew.

Soviet specialists have found that stable chamber operating conditions are essential for the assurance of high quality meat. Fluctuating temperatures or improperly stacked meat can cause unnecessary shrinkage. Soviet State standards mandate that temperatures fluctuate by no more than 5°C. One method used to prevent fluctuations in temperature is the reduction of warm currents in the refrigeration chamber through the installation of hermetically-sealed doors. Another effective means for reducing the loss of frozen meat in storage is to install ice screens in the refrigeration chamber. This decreases the amount of incoming heat. Ice screens serve as protective structures to reduce the amount of radiative exchange between the product and the cooling equipment. The screens provide additional moisture in the chamber, and thus, raise the relative humidity. In addition, the screens serve as a backup layer of cold in the event of a power failure or some other cause of refrigeration disengagement.

4.4 Transportation of Foodstuffs

All food products require careful handling during transportation, loading and unloading. To preserve quality, from the time of production until the time the product reaches the consumer, food should be kept at the recommended storage temperature. Constant temperatures should be maintained in the warehouse and during transportation.

4.4.1 Railroad

Shipping perishables by rail requires an efficient and well-orchestrated system of refrigerated cars. Current Soviet standards permit distribution of frozen meat and fish in iced railroad (as opposed to

refrigerated) cars or sections at temperatures no warmer than -9°C. Although these standards allow frozen meat and most types of frozen fish to be shipped in iced cars, it is on the condition that the temperature is no higher than -5°C. However, as a greater number of refrigerated cars are made available, there is less need for iced cars.

Soviet standards stipulate that refrigerated meat and fish be kept at a temperature of -1°C to -5°C during shipping. Other perishables, depending on the specific product and the season, are usually shipped in accordance with the "Statutes on Railroad Transportation in the USSR." Sometimes, special arrangements are made between the manufacturers and distributors. Temperatures for frozen meat and fish are not supposed to be lower than -9°C, however, there are many cases in which temperatures have been lowered to -12°C. Not surprisingly, such temperature fluctuations compromise product quality. Infractions of temperature regulations during transportation can cause irreparable damage to foodstuffs. It is well-known that the greatest damage to food products stems from prolonged exposure to high temperatures. In modern refrigeration cars, temperatures can usually be adjusted to a level fairly close to optimal (-9°C).

In 1966, the Briansk Automotive Plant (BAZ) cleared for use by the railroad industry a large number of refrigerated cars with cooling capacity greater than East German cars. Previously, the Soviets relied heavily on East German refrigeration cars as one of the most reliable means of transportation. BAZ-manufactured cars are built for five-section refrigerated cars, and are designed to accommodate temperatures in the cargo area from -20°C to -14°C with an outside temperature of -45°C to -30°C.

It is essential that plants of the Soviet railroad industry continue to improve the design of refrigerated cars. East German refrigerated cars are capable of transporting quick-frozen products at temperatures no lower than -15°C, but with an increase in the production of quick-frozen foodstuffs in the past ten years and a gradual lowering of storage temperatures, it has become necessary to lower the storage temperature of perishables to -20°C. This is possible only in individual cars which automatically maintain a set temperature. In isothermically cooled cars, stops at stations for ice are eliminated, and consequently, delivery time is significantly shortened. Before loaded into the cars, perishables are kept at the following temperatures: frozen goods no lower than -8°C; refrigerated from 0°C to 4°C; rapidly-frozen products no lower than -18°C.

Since the mid-seventies, many Soviet food-processing plants have stored frozen products at temperatures of -18°C and lower. At these temperatures, the quality of products can be preserved for prolonged periods. Furthermore, goods shipped at this temperature have an accumulated supply of cold, which is essential during transportation. In the warmer months, the surplus of cold allows for transportation in iced cars without a partial thawing of the outer layers of the product. As temperatures are lowered, however, Soviet food packaging technology must also be upgraded to withstand colder temperatures and stacking. Soviet-grown perishables are shipped to the Artic, Far East and other regions where they are transferred to naval vessels, and are repacked for shipping.

Many Soviet factories do not have direct access to railroads, and therefore must deliver perishables to cargo rail stations. In many instances, these stations are located far away from the food-processing

plant. The preservation of food quality under these circumstances is far worse than if the products had been loaded directly from the plant to isothermal cars.

The consignor is obliged to submit quality certification for all products, including a commerical ranking weight, and maximum allowable transportation time for each batch of goods. For frozen and refrigerated products, the storage temperature should also be indicated. When plants without direct access to railroads dispatch perishables to shipping stations, the consignor is required to submit a quality certificate for each product, as well as the distances and temperatures at which the products must be transported.

Transportation clerks are responsible for verifying the quality of shipments via exterior inspections. The condition of the shipment may be inspected on the consignor's premises as well as during shipment. Proper cargo storage in the railroad cars is essential for preserving the quality of perishables during shipping. Storage should ensure continuous air circulation, stable temperatures and effective utilization of space. Frozen cargo is compactly stacked with no space between the rows. Perishables are supposed to be quickly unloaded into refrigerators and transferred to their designated storage areas.

4.4.2 Water Transport

Water transportation in the Soviet Union is the least expensive form of transporting foodstuffs. Barges are often used for bulk shipments of fruits and vegetables. The vessels are painted white so as to reflect the sunlight, and are equipped with refrigeratedin holds. Prior to departure, the appropriate temperature is set in the hold, taking into consideration the likely leakage of cold from the cargo area during

loading and unloading. Marginal temperature fluctuations, even a change of even 2°C, can cause permanent damage.

Temperature control during loading, transportation and unloading is monitored by thermographs or conventional thermometers. Data from remote-controlled thermometers is recorded in the ship's journal every four hours. Either the thermographs or ship's journal records are attached to the other accompanying documentation of the shipped goods.

4.4.3 Truck Shipments

Truck shipments are widely used for intra-city and inter-city deliveries. The advantage of truck shipments is their high maneuverability, and uninterrupted delivery of goods from the place of manufacture directly to distribution points or retail locations. The carrying capacity of trucks without trailers usually ranges from 1.5 kilograms to 5 tons.

Small capacity motor transport is employed primarily for intra-city or short distance deliveries. Refrigerators are occasionally used. Frozen products are simply kept cool from their own reserves of cold. Refrigerated trucks with one or several trailers are also widely utilized The average carrying capacity of refrigerated trailers ranges from 7.10 to 12 tons and can quickly transport perishables up to 3,000 kilometers. Refrigerated means of motor transportation are equipped with permanently installed refrigeration systems. For meat and fish shipments, a temperature ranging from -20°C to -1°C can usually be maintained. The minimum GOST requirement for meat and fish shipments in refrigerated trucks is a temperatuare no lower than -9°C.

Aside from refrigerated and isothermal motor transportation, unrefrigerated vans are used. The vans are usually covered. If a van

does not have a permanent covering, another material is used to protect the shipment from dust, sunlight, deposits and other harmful environmental influences.

Specialized motor fleets are sometimes used for the delivery of some foodstuffs. Thus, for example, bread is delivered in vans, equipped specifically for this purpose. Shelves or angle bars are installed in the vans. Bread vans are not supposed to be used for other purposes. Loading and unloading procedures are completely automated and the bread is delivered to the store without removing it from the containers.

Fruits and potatoes are delivered by motor vehicles from the farm fields to an interim storage site (gorplodoovshch) in special containers. These containers are delivered to warehouses and stored in three to four tiers. Storing potatoes and vegetables in these containers ensures the greatest protection of the product and reduces losses considerably. When delivery schedules are not met, however, the losses of agricultural products can be enormous.

AFTERWORD

Although the Soviet food-processing industry was reconstructed in the post-War period, it was not until the mid-1980s that quality control became a priority for the industry. Traditionally, Soviet planning authorities have emphasized the importance of industrial technology over the production and quality maintenance of consumer goods. Consequently, the budget for renovating and upgrading the food-processing industry remained fairly small during the late fifties and sixties.

Now, as a part of his economic plan of reconstruction, perestroika, General Secretary Gorbachev has openly recognized the inadequacies of the Soviet food-processing industry. In this monograph, the author highlights the main features of the Soviet food industry, including the institutional framework in which research is conducted and standards are developed, quality control programs at the enterprise, republic and national levels, technology for preserving and evaluating the quality of food products, and current packaging, storage and transportation practices. While addressing these issues, it became clear that there are many shortcomings in the Soviet food-processing industry, and there is considerable need for upgrading. This can only be achieved through sizable capital investments. Even as this monograph is going to press, Gorbachev announced his plans to invest $1.6 billion, which had been borrowed from Western creditors, to modernize the Soviet food and consumer goods industry, although there are still no details as to how the funds will be appropriated.

Even in light of perestroika, change in the Soviet food industry will be slow. One of the key changes, thus far observed is the program of Gospriemka or State Acceptance. This program, while applying to all branches of industry, is one of the few mechanisms for rejecting

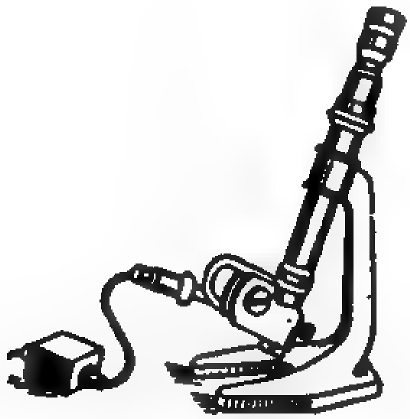
substandard products.

As mentioned in the introduction, the technology of food-processing integrates diverse scientific disciplines. As a result, even if improvements are made in one step of the cycle, for example in the technology of pasteurization, there is no guarantee that the improvements will survive until the end of the cycle. Faulty packaging or fluctuating storage temperatures could undermine all of the efforts to improve pasteurization technology.

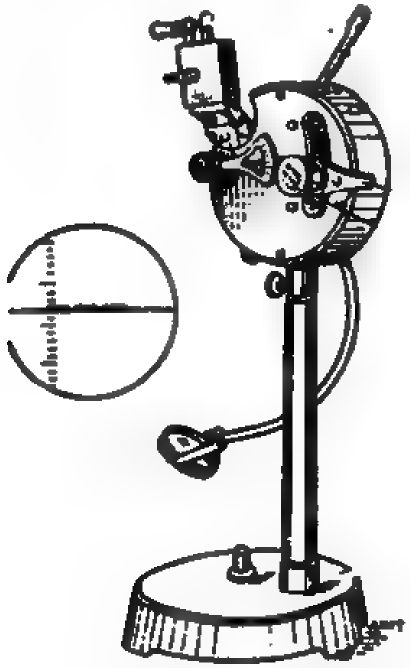
The objective of perestroika, is a difficult one. To make up the technological lag with the West, or even, to ensure quality output, the Soviet food-processing industry will require many improvements. Ultimately, the success of this program depends on Gorbachev's ability to manage the much cited human factor.

APPENDIX

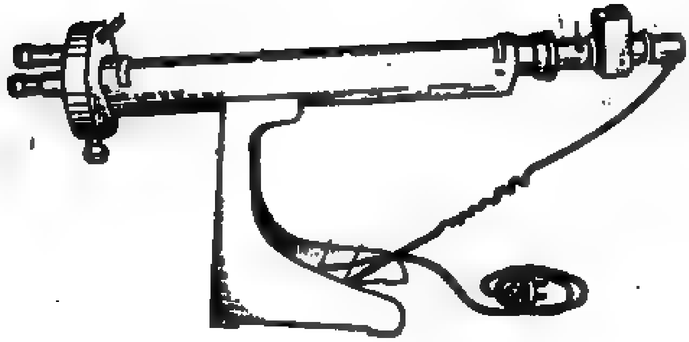
As described in Chapter III (section 3.5), the Soviets use equipment to test the quality of foodstuffs which is similar to that used in Western countries. Presented below are some illustrations of the equipment described in the third chapter.



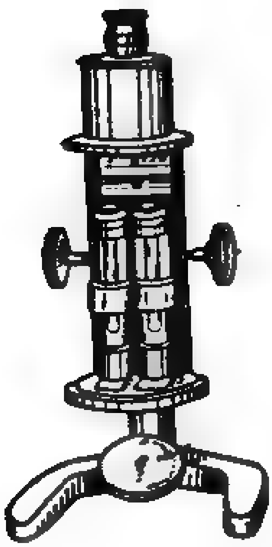
RPL-2 Precision Refractometer



RL Laboratory Refractometer



SU-3 Saccharimeter



Dyubosk Colorimeter

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